PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page 3 of cover*

MATHEMATICS 51

1 : 621–53 487

method of analysing the behaviour of linear systems me series. TUSTIN, A. *J. Instn Elect. Engrs, Pt IIA,* No. 1) 130–42 (1947).—By a linear system is meant a of interacting variables such that a variation of any variable causes variations of one or more of the rs, and in which the principle of superposition lies. In the method of analysis given, time functions represented by the sequences of numbers giving the hts of successive equally spaced ordinates, or an ivalent. Such sets of numbers, represented by a le symbol or regarded as single "multi-place" bers, may be "multiplied," "divided," "added" or btracted" by stated rules so that the numerical lications of any operational equation may be found direct calculation. The rules for combining such ti-place numbers resemble very closely those of inary multiplication, addition, etc., of decimal bers, except that "carrying" is forbidden. The owing are discussed as examples of applications of the hod: (*a*) analysis of the performance of systems in ch definite time delays occur, such as the response- e of a human operator; (*b*) the design of means of ilizing closed-cycle control systems. A.

.22 488

rue partial derivatives of derivatives. KIMBALL, W. S. *l. Mag.*, **38,** 32–45 (*Jan.*, 1947).—A continuation of vious work [Abstr. 1971 (1941)]. Formulae are ained for the partial derivatives in terms of the gral variables x and y on a curve $y = \phi(x)$, and strations are taken from the cubic and catenary ves. L. S. G.

3.5 : 621.317.39 = 82 489

Electrical multi-dimensional models with amplifiers. TENMACHER, L. I. *Bull. Acad. Sci. URSS, Dep. Sci. ch.* (*No.* 5) 511–28 (1947) *In Russian.*—[Abstr. 570 B 48)].

518.5 : 621.317.39 : 534.321.9 *see Abstr.* 559

518.5 : 621.317.757 = 82 490

Electrical apparatus for solution of linear homogeneous and non-homogeneous differential equations of higher order with constant coefficients, yielding the solution in terms of a Taylor series. TOLSTOV, Y. G. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 3) 319–22 (1947) *In Russian.*—[Abstr. 591 B (1948)].

518.5 : 621.392.6 : 621.317.39 491

An electrical network for determining the eigenvalues and eigenvectors of a real symmetric matrix. MANY, A., AND MEIBOOM, S. *Rev. Sci. Instrum.*, **18,** 831–6 (*Nov.*, (1947).—[Abstr. 575 B (1948)].

519.2 492

The foundation of the theory of probability. II. SCHRÖDINGER, E. *Proc. R. Irish Acad.*, **51 A,** 141–7 (*June*, 1947).—A continuation of a previous paper [Abstr. 2001 (1947)]. The product-rule, which was introduced as an axiom, is now introduced more satisfactorily. This involves an investigation of the normalization of the "measure of likelihood." L. S. G.

519.21 = 4 493

Random functions of the second order. LOÈVE, M. *Rev. Sci., Paris,* **84,** 195–206 (*Sept.* 1, 1946) *In French.*—A general study is made of covariants, and the properties of random functions of the second order are developed. These include differential and integral properties, and some of these are connected with properties of linear sets in Hilbert space. L. S. G.

519.21 : 531.19 = 4 *see Abstr.* 529–30

519.25 = 5 494

On an asymptotic approximation in the probability theory of particle counters. ASCOLI, G. *Ric. Sci. Ricostruz.*, **17,** 611–16 (*May*, 1947) *In Italian.*—A rigorous proof of an approximation formula given by Lovera [Abstr. 2377 (1947)]. N. L. J.

ASTRONOMY . ASTROPHYSICS . GEODESY 52

1.042 : 539.155.2 = 3 *see Abstr.* 703

2.58 495

An automatic guider for astronomical telescopes. BCOCK, H. W. *Astrophys. J.*, **107,** 73–7 (*Jan.*, 48). *Summary in Rev. Sci. Instrum.*, **18,** 854–5 (*Nov.*, 47).—A knife edge bisecting the image of the star in auxiliary telescope rotates about an axis $\perp$ to the ge, and any misalignment causes a modulation in the tput of a photo-multiplier tube receiving the light om the other half of the image. This modulation is en used to control motors correcting "seeing" and iving mechanism residual errors. The Mount Wilson 0″ reflector is being satisfactorily guided by this vice.

3.11 : 539.155.2 496

An experimental method for the estimation of the age the elements. BROWN, H. *Phys. Rev.*, **72,** 348 (*Aug.* , 1947).—A possible method is described for estimating e time that elapsed between the formation of elements d their separation into meteoritic matter. W. E. D.

3.161 497

Remarks on F. Cernuschi's paper, "The physics of smic grains." TER HAAR, D. *Astrophys. J.*, **106,** 4–5 (*Nov.*, 1947).—[See Abstr. 1704 (1947)].

523.25 : 523.7 498

Spontaneous development of a gaseous disc revolving round the sun into rings and planets. I–II. BERLAGE, H. P., JR. *Proc. K. Ned. Acad. Wet.*, **43** (*No.* 4) 532–40; (*No.* 5) 557–66 (1940).—Continues earlier work [Abstr. 4898 (1935)]. Second order variations from the nearly stationary state show that the disc will tend to condense into rings of radii $\simeq$ planetary distances from the sun. It is suggested that planets, with masses of the correct order, might be formed by condensation of the rings. R. A. N.

523.5 : 551.557 499

Long enduring meteor trains. OLIVIER, C. P. *Proc. Amer. Phil. Soc.*, **91,** 315–27 (*Oct.* 24, 1947).—A revised list of data on some hundreds of meteor trains enduring long enough for drift to be measured is given. Vector diagrams representing drift directions and velocities are included and the results analysed and discussed.

523.661 500

On the temperature of cometary nuclei. MINNAERT, M. G. J. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 8) 826–35 (1947).—Considers stone and iron meteorites moving in the orbit of Halley's comet and a stone meteorite moving in a parabolic orbit. Nuclei are treated as swarms of

blocks, and temps. are computed throughout the block for different positions in the orbit. Max surface temps. near perihelion $\simeq 310°$K for stone and 210° for iron. R. A. N.

523.7 : 523.25 *see Abstr.* 498

523.72 = 4 501

A study of the conditions of emission of radio waves by the sun's atmosphere. DENISSE, J. *Rev. Sci., Paris*, **84**, 259–62 (*Sept.* 15, 1946) *In French.*—The emission of electromagnetic radiation by electrons moving in the magnetic field of a sunspot is discussed. The power emitted from the region where the magnetic field is strong is calculated. In the corona, radiation with a wavelength of 10 cm is possible. For such radiation to escape a very high field gradient is necessary. The intensity at the earth's surface is estimated. L. S. G.

523.72 : 523.755 502

On solar radiation in the radio-spectrum. GINSBURG, V. L. *C.R. Acad. Sci. URSS*, **52** (*No.* 6) 487–90 (1946).—The propagation of radio-waves in the sun's corona is examined, and it is shown that the study of solar radiation in the radio-spectrum gives a means for ascertaining the temperature of the corona. Recent experimental results and deductions from these [Abstr. 2112, 2861 (1945), 2450 (1946)] are criticized. L. S. G.

523.746 503

On the theory of sunspots. WALÉN, C. *Ark. Mat. Astr. Fys.*, **30 A** (*Paper* 15) 87 *pp.* (1944).—Alfvén's theory [Abstr. 460, 462, 637 (1945)] is developed further. The shape of the electromagnetic-hydrodynamic waves is investigated in detail and the way in which they are created and produce sunspots is studied. Closed magnetic rings are assumed to be produced in the interior of the sun by hydrodynamic vorticity; the rings travel along the lines of force of the sun's general magnet field and, upon reflection at the sun's surface, give ri to a pair of sunspots or a sunspot group. L. S.

523.746 5(

Statistical tests of H. Alfvén's theory of sunspo GALVENIUS, I., AND WOLD, H. *Ark. Mat. Astr. Fy* **34 A** (*Paper* 24) 9 *pp.* (1947).—Usual statistical tes cannot be applied to the theory. The authors therefo attack the problem by the use of experimental rando sampling, and it is stated that the tests give fairly stro support to Alfvén's theory. V. C. A.

523.755 : 523.72 *see Abstr.* 502

523.841 5(

Photo-electric light-curves of RR Lyrae, TU Cassiopeia and T Monocerotis. GORDON, K. C., AND KRON, G. I *Astrophys. J.*, **106**, 318–24 (*Nov.*, 1947).

523.841.11 : 523.87 5(

The spectrum of T Coronae Borealis at its 1946 ou burst. MORGAN, W. W., AND DEUTSCH, A. J. *Astrophy J.*, **106**, 362–5 (*Nov.*, 1947).

523.841.37 5(

Colors of seven Cepheid variables in Cygnus. HEYDE F. J. *Astrophys. J.*, **106**, 325–38 (*Nov.*, 1947).

523.841.9 5(

A photo-electric study of the eclipsing binary Al Cephei = HD 216014. HUFFER, C. M., AND EGGEN, O. *Astrophys. J.*, **106**, 313–17 (*Nov.*, 1947).

523.841.9 50

Tables facilitating the least-squares solution of a eclipsing binary light-curve. IRWIN, J. B. *Astrophys. J* **106**, 380–94 (*Nov.*, 1947).

523.87 : 523.841.11 *see Abstr.* 506

PHYSICS 53

53.081.4 : 548.73 : 537.531 *see Abstr.* 653

53.082.75 : 621.357.1 : 621.317.31.082.75 510

Electrolytic recorder paper. CURRAH, J. E., ARTHUR, E. M. S., THEIRS, R. E., MCBRYDE, W. A. E., AND BEAMISH, F. E. *Industr. Engng. Chem.*, **39**, 1286–8 (*Oct.*, 1947).—[Abstr. 560 B (1948)].

53.087.6 : 621.317.755 511

Cathode ray presentation of three-dimensional data. SCHMITT, O. H. *J. Appl. Phys.*, **18**, 819–29 (*Sept.*, 1947).—[Abstr. 590 B (1948)].

FUNDAMENTALS 530.1

530.12 : 530.145 512

On quantized space-time. YANG, C. N. *Phys. Rev.*, **72**, 874 (*Nov.* 1, 1947).—Snyder's theory [Abstr. 1120 (1947)] is generalized to give a wider invariance than was achieved in that case by using a curved space-time. Examples are given. W. E. D.

530.12 : 531.18 513

Relativistic dynamics of spin-fluids and spin-particles. WEYSSENHOFF, J., AND RAABE, A. *Acta Phys. Polon.*, **9** (*No.* 1) 7–18 (1947).—Relativistic equations of motion are obtained for a fluid with intrinsic angular momentum, and from these the equations of a particle are deduced. In suitable reference frames the motion of a free particle is found to be a uniform circular motion superposed on a uniform translation. The particle equations are those previously obtained by Mathisson [Abstr. 970 (1938)] and Frenkel [Abstr. 2371 (1926)]. The equations of motion are also given when an electromagnetic fiel is present. G. J. K

530.12 : 531.18 51

Relativistic dynamics of spin-particles moving with th velocity of light. WEYSSENHOFF, J., AND RAABE, A. *Act Phys. Polon.*, **9** (*No.* 1) 19–25 (1947).—The equations o motion of a classical particle with spin, moving with th velocity of light, are derived indirectly from genera equations for any velocity, and the general motion of free particle obtained [Abstr. 513 (1948) and 204 1946)]. G. J. K

530.12 : 531.18 51

Further contributions to the dynamics of spin-particle moving with a velocity smaller than that of light. WEYSSEN HOFF, J. *Acta Phys. Polon.*, **9** (*No.* 1) 26–33 (1947).—Equations of motion of such classical particles [Abstr 513 (1948)] are derived in a simple manner by writin the 3-dimensional equations in tensor form. G. J. K

530.12 : 531.18 51

Further contributions to the dynamics of spin-particle moving with the velocity of light. WEYSSENHOFF, J *Acta Phys. Polon.*, **9** (*No.* 1) 34–45 (1947).—Previou equations [Abstr. 514 (1948)] are obtained in a simpl manner and the properties of the equations, includin the constants of motion, are discussed in greater detail. G. J. K

530.12 : 531.18 : 537.122 51

On two relativistic models of Dirac's electron WEYSSENHOFF, J. *Acta Phys. Polon.*, **9** (*No.* 1) 46–5 (1947).—One model discussed is a classical spinning

rticle with finite velocity. The second is a similar rticle moving with light velocity whose mean position ves in the same way as an electron. The analogy is ed on earlier work on the motion of such particles bstr. 514–16 (1948)]. G. J. K.

0.14 : 539.152.1 = 4 518

Remarks on the theory of the nucleus. BLOCH, L. *J. ys. Radium* (*Sér.* 8) **8**, 161–4 (*June*, 1947) *In French.*— e unquantized equations of the vector meson are ended by a classical analogy with the ultimate aim of minating the present difficulties of nuclear forces. G. J. K.

0.145 519

Transformation properties and spin in the meson theory Eriksson. BRUNO, B. *Ark. Mat. Astr. Fys.*, **35 A** *aper* 1) 9 *pp.* (1947).—The transformation properties of s theory [Abstr. 34 (1948)] are discussed using general operties of generalized Dirac equations. The sym- tric angular momentum tensor shows that the spin of mesons is 1. G. J. K.

0.145 520

Relativistic invariance of the quantum theory of radia- n. MA, S. T. *Phys. Rev.*, **72**, 1090–6 (*Dec.* 1, 1947).— is shown that the current formulation of the quantum ory of radiation, which is concerned solely with the antization of the transverse part of the electromagnetic ld, is in conformity with the principle of relativity. e relativistic invariance of the quantum theory of the utral-vector meson field is also discussed. A.

0.145 = 3 521

The quantum theory of wave fields and smallest length. MARCH, A. *Acta Phys. Austriaca*, **1** (*No.* 1) 19–41 947) *In German.*—A shortest distance is introduced by e assumption that particles at a smaller distance cannot separated in any way, and its implications in a lativistic theory are discussed. An outline is also given the effect on the form of the electromagnetic equations d cross-sections for processes involving free electrons. G. J. K.

0.145 = 4 522

The reflection of particles of half-integral spin. TIAU, G. *Rev. Sci., Paris*, **85**, 135–42 (*Feb.* 1, 1947) *In ench.*—The passage of such a particle across a potential rrier or potential drop is limited to certain momenta for a Dirac electron. Moreover, as the equations ed have plane wave solutions for a spectrum of masses, e transmission involves a change in proper mass for rtain potentials and momenta. G. J. K.

0.145 = 4 523

Wave equations of the second order in meson theory. TIAU, G. *J. Phys. Radium* (*Sér.* 8) **8**, 116–22 (*April*, 947) *In French.*—Equations are obtained for a particle spin 1 in an electromagnetic field, when the particle is scribed by a vector or scalar field, the meson matrix quations or the wave-equations of de Broglie. G. J. K.

0.145 = 4 524

A summary of four lectures by Dirac on second antisation. BARANGER, M., AND NETTER, F. *Rev. Sci., aris*, **85**, 623–32 (*June* 1 *and* 15, 1947) *In French.*

0.145 : 530.12 *see Abstr.* 512

0.145 : 535.14 525

The theory of radiation damping. HAMILTON, J. *Proc. hys. Soc., Lond.*, **59**, 917–40 (*Nov.*, 1947).—The problem f radiation emission and scattering by particles in a osed box is solved exactly with certain approximations. he purpose of the work was to examine the roles played the usual solutions by degeneracy, perturbation chnique and the type of model employed, with special ference to the Heitler–Peng damping equation. G. J. K.

530.145 : 538.3 526

On the divergences of quantum electrodynamics. LOPES, J. L. *An. Acad. Brasil. Cienç.*, **19** (*No.* 1) 51–66 (*March* 31, 1947).—An investigation is made of the effect upon the self-energies of additional conditions added to those of Schönberg [Abstr. 1824 (1945)]. The analysis follows closely Pauli's treatment of Dirac's theory [Abstr. 351 (1944)]. It is concluded that it is not possible to eliminate both the transverse and electromagnetic self-energies. L. S. G.

530.145.6 : 535.5 527

The interaction of radiation and matter. DAVIDSON, P. M. *Proc. Roy. Soc. A*, **191**, 542–52 (*Dec.*, 1947).— Radiation theory can be based on wave mechanics of the usual type with extra terms which describe the actual annihilation of atoms in the states acting as sources and sinks. The theory will be free from the divergences and difficulties of other theories. Although this annihilation does not actually occur it may be assumed that there is a quasi-static dependence of the actual processes on these extra terms, so that the solution describes them correctly. All processes which essentially depend on the sinks and sources should be ignored in the physical interpretation. G. J. K.

530.145.6 : 537.122 = 4 *see Abstr.* 614

530.145.61 528

A note on transmission across potential barriers. AULUCK, F. C. *Phil. Mag.*, **38**, 289–91 (*April*, 1947).— The transmission coefficient is calculated in the case of two constant-potential regions connected by a region in which the potential varies linearly. Airy integrals are involved. L. S. G.

530.162 : 539.185 *see Abstr.* 756

GENERAL MECHANICS
MECHANICS OF SOLIDS 531

531.18 : 530.12 *see Abstr.* 513–16

531.18 : 537.122 : 530.12 *see Abstr.* 517

531.19 : 519.21 = 4 529

Random mechanics. I. DEDEBANT, G., AND WEHRLÉ, P. *Portugal. Phys.*, **1** (*Pt* 3) 95–149 (1944) *In French.*— The use of statistics, and in particular random functions, in physics is discussed. Properties of random functions and distribution functions are developed, including differentiation and integration of random functions. As an example a detailed study is made of an oscillator with random frequency. L. S. G.

531.19 : 519.21 = 4 530

Random mechanics. II. Physical applications. DEDEBANT, G., AND WEHRLÉ, P. *Portugal. Phys.*, **1** (*Pt* 4) 179–294 (1945) *In French.*—The work of Part I [Abstr. 529 (1948)] is extended, and the whole is applied to a study of "random" particles which are suitably defined. Distribution functions for these are set up, and the thermodynamics of random particles is studied. The idea of an assembly of such particles is next introduced and the various concepts necessary to derive results with physical meaning are developed. Diffusion is studied in detail. Two examples of random particles are given, the free particle and the plane rotator. Equations of motion for a system of particles are set up, interaction being considered. Quantization of energy is obtained and interpreted. L. S. G.

531.19 : 541.183 *see Abstr.* 768

531.224.5 : 621.315.17.056 = 3 531

Bending stresses in wire ropes. CZITARY, E. *Öst. Ingen. Arch.*, **1** (*Nos* 4–5) 342–50 (1947) *In German.*—

A mathematical investigation based on kinematic considerations shows that Reuleaux's expression $E\delta/2r_s$ for the bending stress of the wires in ropes is correct if the radius of curvature $r_s \gg$ rope diameter. (E = Young's modulus, δ = thickness of wire.) The results of the investigations are in accordance with test results which show that (1) the wires within a half-winding of a spiral rope are shifted from the concave inner to the convex outer side, the largest shift occurring in the middle section, (2) no longitudinal forces appear in the wires, (3) the rope cross-section remains essentially plane. Torsional forces may be neglected. Conclusions are drawn on the behaviour of stranded ropes consisting of inter-twined spiral ropes. For relatively small twisting angles of the spiral ropes and the stranded ropes the change of curvature is $\sim 1/r_s$, independent of the fact whether the twist of the stranded rope is in the same or the opposite direction of that of the spiral rope. R. N.

531.261 532

A new method for computing the energy of interaction between two spheres under a general law of force. BOUWKAMP, C. J. *Physica, 's Grav.*, **13**, 501–7 (*Sept.*, 1947).—A Laplace transform method is used to show that the energy of interaction may be written in the form of an inf. integral, whose integrand involves Bessel functions. Explicit closed formulae for the energy are found when the potential function is r^{-n} where $n = 2$, 3, 4, 5, 6 and 7. The method may be used to calculate the interaction energy in the case of two disc-like particles in a plane. L. S. G.

531.382 : 535.215 *see Abstr.* 567

531.391.5 : 534.01 = 4 533

Study of the stability of systems accessible to measurement. ROCARD, Y. *Rev. Sci., Paris*, **85**, 519–37 (*May* 15, 1947) *In French.*—For a vibrating system subjected to a periodic disturbing force of frequency $2\pi\omega$, resistance R and reactance X are functions of ω. The impedance curve (R as abscissa and X as ordinate), and certain related curves, are used to indicate stability, or conditions leading to increased sensitiveness, i.e. instability of the system. The application of the curves depends upon the proposition that, for stability of the system, the resistance should be positive and impedance should increase with frequency at each resonance of the reactance. The required curve may be determined by experiment. Examples are given to indicate the information obtainable from the curves relating to stability for various mechanical systems. These systems include amplifiers with reaction and speed regulators. G. G.

531.53 = 4 534

Remark on the maintenance of the motion of a pendulum by an alternating current. CASSIGNOL, C. *C.R. Acad. Sci., Paris*, **224**, 717–19 (*March* 10, 1947) *In French.*—A mathematical study is made of the oscillations when the amplitude is small. The differential equation giving the current in the circuit is not integrable, but an approx. solution for small amplitudes is obtained. This leads to a limit in the possible values of one of the circuit parameters, the inductance. L. S. G.

531.53 = 4 535

On the maintenance of the motion of a pendulum by an alternating current. CASSIGNOL, C. *C.R. Acad. Sci., Paris*, **224**, 1754–6 (*June* 25, 1947) *In French.*—A continuation of previous work [Abstr. 534 (1948)]. Assuming the conditions for the motion to be maintained are satisfied, the problem now solved is that of deciding whether the oscillations are limited in amplitude or cease to remain small. L. S. G.

MECHANICAL MEASUREMENTS 531.7

531.714.7 : 621.317.39 53

Electronic micrometer. GREENOUGH, M. L. *Radio Electronic Engng*, **9**, 11–13, 26 (*Aug.*, 1947).—[Abstr. 571 B (1948)].

531.784 : 621.317.381 53

Measuring torque without contact. WOMMACK, K. I. *Westingho. Engr*, **7**, 76–8 (*May*, 1947).—[Abstr. 569 (1948)].

531.788.7 : 621.316.721.076.2 53

A circuit for the control of ionizing current by a saturable core transformer. BANERJEE, B. M., AND MUKERJEE, A. *Indian J. Phys.*, **21**, 90–100 (*June*, 1947).—[Abstr. 539 (1948)].

MECHANICS OF LIQUIDS 532

532.13 : 541.18.041.2 53

A calculation of the viscosity and the sedimentation velocity for solutions of large chain-molecules taking into account the hampered flow of the solvent through each chain molecule. BRINKMAN, H. C. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 6) 618–24; (*No.* 7) 821 (1947).—Using a single model and assuming that in solutions of long-chain polymers the flow of solvent through the molecular clusters is hampered as if the cluster was a porous sphere, calculations are made of both viscosity and sedimentation velocity. The amended calculations show reasonable agreement with published data on viscosity but the agreement is not so good with known sedimentation constants. J. I.

532.133 : 538.569.3 : 537.226.1 *see Abstr.* 631

532.137.08 : 621.317.39 54

Electronic timer for viscosity measurements. *Radio Electronic Engng*, **9**, 7, 31 (*Sept.*, 1947).—[Abstr. 572 (1948)].

532.5 : 539.501 54

Hydrodynamics of non-Newtonian fluids. RIVLIN, R. S. *Nature, Lond.*, **160**, 611 (*Nov.* 1, 1947).—General stress strain-velocity relations of incompressible fluids have been applied to two cases of the shear motion of cylindrical masses of fluid; forces are found to be necessary on the ends of the cylinders, if the fluids are non-Newtonian.

532.51 54

Kolmogoroff's theory of locally isotropic turbulence. BATCHELOR, G. K. *Proc. Camb. Phil. Soc.*, **43** (*Pt* 4 533–59 (1947).—Kolmogoroff's theory of turbulent motion [*C.R. Acad. Sci. URSS*, **30**, 301–5 (1941); 32 16–18 (1941)] is briefly outlined. The basic notion of the theory is that, at high Reynolds number, all kinds of turbulent motion of arbitrary mean-flow characteristics show a similar structure if attention is confined to the smallest eddies. The motion due to these eddies is isotropic and statistically steady. Within this range of eddies two limiting processes are recognized. The influence of viscosity on the larger eddies of the range is negligible if the Reynolds number is large enough. The quantity of energy continually passed on to smaller eddies from larger eddies is the local mean energy dissipation due to turbulence. The smaller eddies dissipate, owing to viscosity, a considerable part of the energy they receive, and motion of the very smallest eddies is entirely laminar. Motion due to eddies $<$ a certain limiting size in an arbitrary field of turbulence is thus determined uniquely by viscosity and the local mean energy-dissipation per unit mass of fluid. The mathematical method of describing motion due to eddies of a particular size is to construct correlations between

erences of parallel velocity-components at two points an appropriate distance apart. Scalar functions urring in the expressions for the correlations are ermined by dimensional analysis. Consequences of theory in turbulent flow possessing ordinary isotropy analysed and predictions made. The prediction that dimensionless ratios of moments of the probability ribution of the rate of extension of fluid in any ction are universal constants, has been confirmed by nt experiments by Batchelor and Townsend so far as nd and third moments are concerned. Other dicted relations have the correct form. J. S. G. T.

516 : 534.413 = 4 *see Abstr.* 560

.517 543

low of a compressible fluid about a cylinder. CHERRY, M. *Proc. Roy. Soc. A*, **192**, 45–79 (*Dec.* 23, 1947).— contrast to the approximate solutions found by locity-correction" methods, a family of *exact* solutions ere found, by the hodograph method. The theory is tricted to the case of zero circulation and the speed at ge distances from the cylinder is subsonic, while the ed near the cylinder is not so restricted. The family solutions involves an ∞ set of constants, which ermine the shape of the cylinder. The velocity nponents are taken as independent variables, and the d equation is linear. The solution is based on a orem whereby a hypergeometric function with large rameters is expressed as a convergent series whose ding term represents the function asymptotically. The mary solution obtained represents flow round a inder which is approximately circular when the ocity at ∞, (q_1), is small, but which becomes flattened q_1 increases. Discussing the recent work of Tsien and o on this subject, the author shows that their theory the analytical continuation of solutions is essentially fective. An improved assumption used by Tsien and o is shown, in the case of their chief example, to be se. J. S. G. T.

2.593 : 532.6 = 3 544

Elementary treatment of ship-waves. LENZ, W. *Ann. ys., Lpz.* (*Folge* 6) **1** (*Nos* 1–3) 75–82 (1947) *In German.* An expression representing the resultant wave-turbance at any point due to the motion of a ship is tained by the summation of effects originating in each cessive element of the ship's path. The investigation pends on the relation of phase-velocity to wave-gth in its general form. From the general expression obtained results are worked out for particular regions special interest within the wave-system by application the principle of stationary phase. These results clude a discussion of the system of capillary waves oduced which is not considered in earlier papers. gner [*Ark. Mat. Astr. Fys.* **17** (*Paper* 12), 50 *pp.* 23)]. G. G.

2.593 : 551.46 *see Abstr.* 787

CAPILLARITY 532.6

2.6 : 532.593 = 3 *see Abstr.* 544

2.61 = 3 545

Surface tension. PRANDTL, L. *Ann. Phys., Lpz.* olge 6) **1** (*Nos* 1–3) 59–64 (1947) *In German.*—A re-amination of surface tension theory in which it is own that the laws of statics enable one to calculate rface tension, leading to the conception that in the rface of a liquid a real tension exists. It is as if the rface were covered by a thin membrane. This, as e author points out, is quite contrary to the usual nception of surface tension. J. I.

532.62 546

A new method of investigation of the stability of two-sided liquid films. SMIRNOVA, A. M., AND REHBINDER, P. A. *C.R. Acad. Sci. URSS*, **52** (*No.* 4) 317–19 (1946).— Apparatus is described for making measurements which allow the stability of films in emulsions or foams to be evaluated. The method involves the measurement of the maximum length of the film before rupture, when being drawn out from the liquid at a constant rate. Results are reported on the stretching in a water medium of films of vaseline oil added to oleic acid. L. S. G.

KINETIC THEORY OF LIQUIDS 532.7

532.72 = 4 547

Determination of the constants of thermal diffusion and ordinary diffusion from experimental results of the pure Soret effect. DE GROOT, S. R. *J. Phys. Radium* (*Sér.* 8) **8**, 129–34 (*May*, 1947) *In French.*—Formulae on the approach to equilibrium in thermal diffusion without convection, which have been deduced previously [Abstr. 2795 (1946)], are applied to some early measurements of the Soret effect. Good agreement with respect to the dependance of concentration on time and dimensions is obtained. The possible influence of the Soret effect on the segregation in molten alloys and differentiation in magmas is discussed and found to be of little importance. H. L.

532.72 = 4 548

On the thermal diffusion in liquids. Limits of the Soret coefficient. DE GROOT, S. R. *C.R. Acad. Sci., Paris*, **225**, 377–9 (*Aug.* 25, 1947) *In French.*—The heats of transport Q_1 and Q_2 evolved by interdiffusion of two solutes 1 and 2 are related to the Soret coefficient s by $s = (Q_1 - Q_2)/kT^2$. Each is related to the energies of detachment q_D and of hole formation q_A in the cage model of liquids by $Q = q_D - q_A$. The latter are related to the constant of self diffusion by $q_D + q_A \equiv q = kT^2 d(\ln D)/dT$. From this follows $kT^2 s < q_1 + q_2$. In the case of isotopes a lower limit for s can be obtained if one makes the hypothesis that the heavier molecule 1 is attached more strongly to its cage ($q_{D1} > q_{D2}$) and requires a smaller hole when changing its position ($q_{A1} < q_{A2}$). This gives $kT^2 s > |q_1 - q_2|$. H. L.

532.782 : 541.123 : 539.11 *see Abstr.* 686

MECHANICS OF GASES 533

533.43/.45 : 551.508.4 549

Recent progress in the measurement of atmospheric pressure. KOPPL, F. *Rev. Sci. Instrum.*, **18**, 850–1 (*Nov.*, 1947).—An evacuated Bourdon gauge made of quartz provides an instrument free from hysteresis with calibration independent of temperature, suitable for low pressure measurements at high altitudes; a brief description is given. A boiling-point hypsometer, with an accuracy of 0·02 mm of Hg, is also described, in which temp. measurements are made with a resistance thermometer.

533.5 550

On the use of alkali metal alloys for trapping mercury vapour. HUNTEN, K. W., WOONTON, G. A., AND LONGHURST, E. C. *Rev. Sci. Instrum.*, **18**, 842–4 (*Nov.*, 1947).— In a Hg-vapour trap of appropriate design an alloy of Na with 5 to 10% K is more satisfactory than either of the metals used alone. The trap does not need reactivation at intervals and, therefore, during its life affords continuous protection. Over a period of 22 days a vacuum system protected by this type of trap was pumped

repeatedly from atmospheric pressure to 5×10^{-7} mm of Hg; during this time the trap required no attention. A.

533.6.01 : 534.222.2 551

Abrupt energy transformation in flowing gases. BAILEY, N. P. *Trans. Amer. Soc. Mech. Engrs*, **69**, 749–63 (*Oct.*, 1947).—Theoretical and actual plane compression shocks in tubes are compared. By making the single-plane-angle shock a special case of a plane shock, curves for solving numerical cases are presented. Traverses of 3-dimensional angle shocks in nozzle and orifice discharges are presented and discussed, and temp. traverses through shock diamonds in high-temp. streams are shown. Thermocouple readings in excess of the total gas temp. in such high-temp. shocks are established. Tests of combustion with flow in a constant-area tube are given. A.

533.6.011.5 552

Linearised supersonic aerofoil theory. I–II. GUNN, J. C. *Philos. Trans. A* (*No.* 820) 327–73 (*Dec.* 9, 1947).—I. The theory is developed by operational methods and a Green's function method, the latter being analogous to that used in diffraction problems, and applicable to problems involving tapered wings or curved leading edges. The operational method, which shows the analogy between supersonic aerofoil problems and other wave problems, may be applied to a wide class of problems. The lift and drag on semi-∞ rectangular wings are calculated; and a finite rectangular wing with arbitrary chord is treated by a recurrence method. II. The drag and lift on swept-back wings are treated, and a recurrence method is used to obtain the lift on a trapezoidal wing with tips swept back beyond the Mach angle. Application is made to the arrow-head wing. L. S. G.

533.6.013.22 : 621.317.39 = 4 553

An amplifier for studying the turbulence of a stream of air. BETCHOV, R., AND KUYPER, E. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 9) 1134–41 (1947) *In French.*—Two hot wire anemometers using Pt filaments 1 to 2 mm long and 3 to 15 μ dia. in similar bridge circuits are used and energized from a common d.c. supply. Each has a pre-amplifier whose time constant is made equal to that of the hot wire, so that the overall frequency characteristic is substantially flat from 10 to 3 000 c/s. The pre-amplifier outputs are applied to a "sum" and a "difference" amplifier. The latter feeds a thermocouple which measures the r.m.s. difference in the velocity past the two filaments. A thyratron operates a relay to protect the couple from overload. Negative feedback through a tuned circuit compensates for the effect of resonance in the anode inductors of the pre-amplifiers. The sum amplifier output is applied to the X plates of a c.r.o. and the difference amplifier output to the Y plates, giving a trace which shows circular symmetry when there is no correlation between the velocity deviation at the two filaments, but elliptical when correlation exists. The tube shows transient correlation. Measurements with the difference amplifier and thermocouple with the bridges fed in the same and in opposite polarity permit the measurement of correlation persisting for sufficient time. C. F. B.

KINETIC THEORY OF GASES 533.7

VIBRATIONS . ACOUSTICS 534

534.01 : 531.391.5 = 4 *see Abstr.* 533

534.113 : 536.21 554

Solutions of problems relating to media in contact by the method of wave trains. GREEN, G. *Phil. Mag.*, **38**, 97–115 (*Feb.*, 1947).—A continuation of previous work [Abstr. 151 (1945)]. Solutions are given in cases when the media concerned are bounded by cylindrical or spherical surfaces. Bessel functions find extensive application. L. S. G.

534.15 : 669.14 : 539.32 *see Abstr.* 764

534.222.2 55

Application of particular solutions of gas dynamic equations to the study of detonation and shock waves. STANIUKOVICH, K. P. *C.R. Acad. Sci. URSS*, **52** (*No.* 7) 589–92 (1946).—The solutions given previously [*C.R. Acad. Sci. URSS*, **48** (*No.* 5) (1945)] are used to study the pressure, density and velocity for spherical detonation and shock waves. Graphs showing the variation of these parameters are drawn. L. S. G.

534.222.2 55

Hydrodynamic properties of sea water at the front of a shock wave. RICHARDSON, J. M., ARONS, A. B., AND HALVERSON, R. R. *J. Chem. Phys.*, **15**, 785–94 (*Nov.* 1947).—The Rankine–Hugoniot relations have been applied to appropriate equation-of-state data in order to calculate the propagation velocity, particle velocity, enthalpy increment, Riemann function, etc., at shock fronts of various amplitudes in sea water. One set of tables provides values over a wide pressure range (up to ~ 80 kbars) and is principally intended for use in conjunction with theories of propagation of shock waves originated by underwater explosions. A second set of tables contains values which are closely spaced up to pressures of 14 kbars. These are calculated with somewhat greater precision and are intended for use in connection with experimental measurements of particle and propagation velocities, etc. A.

534.222.2 : 533.6.01 *see Abstr.* 551

534.222.2 : 541.126 55

Theory of the propagation of shock waves from infinite cylinders of explosive. BRINKLEY, S. R., JR., AND KIRKWOOD, J. G. *Phys. Rev.*, **72**, 1109–13 (*Dec.* 1, 1947).—The assumption of energy dissipation at a single shock [Abstr. 1767 (1947)] is employed in the formulation of a pair of ordinary differential equations for peak pressure and shock-wave energy as functions of radial distance from the source of the shock wave produced by an ∞ cylinder of explosive along which a stationary detonation wave is travelling with finite velocity. The profile of the wave may be determined by means of an auxiliary integration. The theory takes proper account of the finite entropy increment of the fluid produced by the passage of the shock, and permits the use of the exact Hugoniot curve of the fluid in the numerical integration of the basic equations. A.

534.321.9 : 535.37 = 4 *see Abstr.* 585

534.321.9 : 620.179.16 55

Ultrasonic resonance applied to non-destructive testing. ERWIN, W. S., AND RASSWEILER, G. M. *Rev. Sci. Instrum.*, **18**, 750–3 (*Oct.*, 1947).—[Abstr. 448 B (1948)].

534.321.9 : 621.317.39 : 518.5 55

Design of mercury delay lines. SHARPLESS, T. K. *Electronics*, **20**, 134–8 (*Nov.*, 1947).—These lines, which consist of Hg columns in stainless steel tubing of 0·5 in. inside dia., act as vehicles for ultrasonic wave trains derived from quartz crystals mounted at the ends. Hg is particularly suitable because of its low acoustic velocity, attenuation, temp. coefficient and convenient acoustic impedance. Used in conjunction with special recirculation and gating circuits, these lines are capable of retaining information, supplied in the form of 0·3 μsec r.f. pulse trains, for an indefinite period, for release when

uired. Their main application lies in electrical nputers. H. G. M. S.

.413 : 532.516 = 4 560

Criterion of sound sensitivity of gas jets and flames. RIÈRE, Z. *J. Phys. Radium* (*Sér.* 8) **8**, 225–33 (*Aug.*, 7) *In French.*—Combining Rayleigh's theory of ability of laminar motion of a fluid, with a knowledge he velocities of flow and of sound propagation, it is sible to obtain a general differential equation, with ngular solution, for the movement of viscous fluids. s equation is sufficient to explain known facts in the aviour of sound-sensitive gas jets and flames. An lanation is given of the sensitivity of very small nes of luminous gas, such as acetylene. The in-sitiveness of the flame of a candle sets a problem of ch the solution has suggested certain paradoxical ervations. A case not less paradoxical is that of the sitivity of an old Auer burner, which is explained by theory. A. B. W.

.414 = 4 561

Pipes containing annular diaphragms. CARRIÈRE, Z. *h. de Phys.* (*No.* 27) 1–17 (*June*, 1945) *In French.*—A dy has been made of the fundamental and higher tial vibrations of (*a*) flexible pipes with corrugated ls; (*b*) parallel cylindrical pipes containing spaced ular diaphragms. If V is the mean velocity of air v, ε the spacing of two consecutive diaphragms, the frequency of the fundamental, then $V = N\varepsilon$. es from 45 to 50 mm diameter and diaphragm rtures 15, 20 or 25 mm diameter were used in the ification of this expression. Sensitive smoke jets e used to obtain visual evidence of the part played the annular diaphragms. The results throw some t on the behaviour of the mouthpiece of a flute. A. B. W.

.511.2 : 535.33 *see Abstr.* 569

.773.2 : 621.395.64 562

Broadened criteria of hearing aid performance. NDEL, A. B., AND CARLISLE, R. W. *J. Acoust. Soc. er.*, **19**, 639–44 (*July*, 1947).—[Abstr. 693 B (1948)].

.78 : 621.396.82 563

Effects of impulsive interference upon a-m voice com-nication. LICKLIDER, J. R. C., AND GOFFARD, S. J. *Acoust. Soc. Amer.*, **19**, 653–63 (*July*, 1947).

.845.2 = 4 564

Sound transparency of elastic panels covered by porous terial. VOGEL, T. *J. Phys. Radium* (*Sér.* 8) **8**, 151–4 ay, 1947) *In French.*—Earlier theoretical results tained for elastic plates either isolated or separated by air space are extended to heterogeneous systems mprising an elastic support with a porous covering h as felt. Upper and lower limits of the acoustic nsparency of these systems are calculated, and the perimental results are shown to lie, in general, between se limits. G. F. H.

.852 : 621.395.625.3 565

Magnetic phonograph pickups. BRUDERLIN, H. H. *dio-Electronic Engng*, **9**, 16–18, 25 (*Sept.*, 1947).—bstr. 692 B (1948)].

OPTICS . RADIATION . SPECTRA 535

5.11 : 537.591 : 539.16 566

Geiger-Mueller counter detection of light radiation from paths of high energy particles. WEISZ, P. B., AND NDERSON, B. L. *Phys. Rev.*, **72**, 431–2 (*Sept.* 1, 1947).—G-M counter which responds to radiation only in the gion 2 000–3 000 Å has been used to detect Čerenkov radiation both from cosmic rays and natural radio-active material. W. E. D.

535.14 : 530.145 *see Abstr.* 525

535.215 : 531.382 567

Rotors driven by light pressure. BEAMS, J. W. *Phys. Rev.*, **72**, 987–8 (*Nov.* 15, 1947).—It was shown that when a 1·59 mm rotor was slowly rotating, its speed could be increased or decreased by suitably directing a beam of light to exert a couple. As the air pressure about the rotor was 10^{-6} mm of Hg the radiometer effect would be negligible. W. E. D.

535.215 : 621.383.42 = 4 568

Additivity of the effects of luminous flux striking different parts of a selenium photo-cell. TERRIEN, J., AND ANGLADE, C. *C.R. Acad. Sci., Paris*, **225**, 729–31 (*Oct.* 27, 1947) *In French.*—[Abstr. 637 B (1948)].

535.215.1 : 537.312.5 *see Abstr.* 645

535.231.4 : 537.583 : 536.33 = 4 *see Abstr.* 599

535.33 : 534.511.2 569

On the possibility of observing beat frequencies between lines in the visible spectrum. FORRESTER, A. T., PARKINS, W. E., AND GERJUOY, E. *Phys. Rev.*, **72**, 728 (*Oct.* 15, 1947).—It is pointed out that it may be possible to detect beats between two Zeeman components of a spectral line by projecting them on to a photocathode, the photo-electrons being detected by a resonant cavity tuned to a frequency Δ, equal to the difference in frequency of the two Zeeman lines. The success of this experiment depends on the life-time of photo-emission being small compared with $1/\Delta$, i.e. $\sim 10^{-10}$ sec. W. E. D.

535.33 : 537.527.5 = 3 *see Abstr.* 650

535.33.072–14 : 537.569.4 570

A modified Stark-effect modulation spectrograph for microwaves. WATTS, R. J., AND WILLIAMS, D. *Phys. Rev.*, **72**, 980–1 (*Nov.* 15, 1947).—The apparatus of Hughes and Wilson [Abstr. 1814 (1947)] is modified by replacing the flat central electrode in the absorption apparatus by a fine wire. Distortion was thus reduced. W. E. D.

535.338.3 : 551.594.5 = 4 *see Abstr.* 791

535.338.3–32 : 539.153 *see Abstr.* 699

535.338.332 : 539.153 *see Abstr.* 700

535.338.334 : 537.531 *see Abstr.* 654

535.338.4 571

Emission spectrum of iodine molecules in the presence of an inert gas. WASER, J., AND WIELAND, K. *Nature, Lond.*, **160**, 643–4 (*Nov.* 8, 1947).—An emission spectrum was photographed from a h.f. discharge in I_2 vapour in the presence of several hundred mm of A and was similar to the fluorescence spectrum found by Elliott [Abstr. 467 (1940)]. An analysis of the well-developed F and E systems is put forward.

535.338.4 : 536.654 : 539.13 *see Abstr.* 687

535.34 : 539.15 : 537.531 *see Abstr.* 655

535.34 : 539.166 *see Abstr.* 733

535.34 : 551.463 *see Abstr.* 787

535.342 : 541.11 = 3 572

The band spectrum and heat of dissociation of BrF. BRODERSEN, P. H., AND SCHUMACHER, H. J. *Z. Naturforsch*, **2a**, 358–9 (*June*, 1947) *In German.*—A system of bands attributed to BrF has been observed in absorption by a mixture of fluorine and bromine at 118°c. The band-head measurements are represented by the following: $\nu_H(\text{cm}^{-1}) = 19335{\cdot}2 + 363{\cdot}0\,u' - 9{\cdot}5\,u'^2 - 671\,u'' + 3\,u''^2$ (with $u' = v + \frac{1}{2}$). There is predissociation at $v' = 7$. Graphical extrapolation gives $D_0' = 2190 \pm 100\,\text{cm}^{-1}$, and this leads to $D_0'' = 59{\cdot}9$ or

50·3 kcal., depending on the states of the products. (See following abstract). R, F. B.

535.342 : 541.11 = 3 573

The band spectrum and heat of dissociation of ClF. SCHMITZ, H., AND SCHUMACHER, H. J. *Z. Naturforsch.*, **2a**, 359–62 (*June*, 1947) *In German.*—New observations have led to a vibrational analysis somewhat different to that originally proposed [Abstr. 2081 (1942)]. The band-head measurements are represented by the following: $\nu_H(\text{cm}^{-1}) = 19826{\cdot}4 + 316{\cdot}3\,u' - 11{\cdot}8u'^2 + 780{\cdot}4\,u'' - 4\,u''^2$ (with $u = v + \frac{1}{2}$). The bands with $v' > 7$ are diffuse. A short extrapolation gives $D_0' = 1900\ \text{cm}^{-1}$, and this leads to $D_0'' = 60{\cdot}3$ or $58{\cdot}9$ kcal., depending on the state of the products. The bearing of these results, and those for BrF (see preceding abstract) on the bond-energy of F_2 is briefly discussed. R. F. B.

535.343.2 + 535.372 = 4 *see Abstr.* 590

535.343.2 : 548.0 : 535.66 574

Erratum: Spectral location of the absorption due to color centers in alkali halide crystals. IVEY, H. F. *Phys. Rev.*, **72**, 873 (*Nov.* 1, 1947).—[Abstr. 3475 (1947)].

535.343.2–15 : 535.5 : 539.13 575

Use of polarized radiation in infra-red analysis. SUTHERLAND, G. B. B. M., AND JONES, A. VALLANCE. *Nature, Lond.*, **160**, 567–8 (*Oct.* 25, 1947).—Investigations, using reflection from a Se mirror, on the absorption spectra of oriented films of various polymers are briefly reported. Also, the confirmation, using this method, of the orientation allocated by X-ray analysis for the CO bond of *p, p'* dibromodiphenyl ketone.

535.343.4 576

The absorption spectrum of ozone in the visible. I. Examination for fine structure. II. The effect of temperature. HUMPHREY, G. L., AND BADGER, R. M. *J. Chem. Phys.*, **15**, 794–8 (*Nov.*, 1947).—No fine structure was observed in spectrograms taken in the second order of a 21-ft grating spectrograph. The absorption coefficients remained constant within experimental error in going from room to dry-ice temperature. A.

535.343.4 = 4 577

Progress in obtaining and interpreting infra-red absorption spectra of gases or vapours. LECOMTE, J. *Rev. Sci., Paris*, **85**, 91–125 (*Jan.* 15, 1947) *In French.*—A detailed review of the results obtained for HCl, CO_2, NH_3 and H_2O, and their theoretical interpretation. It contains 60 figures and a bibliography of 186 items. R. F. B.

535.343.4–14 578

Further work on satellites in the microwave spectrum of ammonia. WILLIAMS, D. *Phys. Rev.*, **72**, 974 (*Nov.* 15, 1947).

535.343.4–14 : 538.615 579

Microwave spectra and Zeeman effect in a resonant cavity absorption cell. JEN, C. K. *Phys. Rev.*, **72**, 986 (*Nov.* 15, 1947).—The microwave spectroscope used a gas-filled resonant cavity as detector. The sensitivity has been increased by modulating the klystron reflector grid with 100 kc/s in addition to the low frequency sweep. With this arrangement the Zeeman splitting could be observed, not only of the main absorption lines of NH_3, but also of the nuclear hyperfine lines. W. E. D.

535.343.4–14 : 539.132 580

Anomalous values of certain of the fine structure lines in the ammonia microwave spectrum. NIELSEN, H. H., AND DENNISON, D. M. *Phys. Rev.*, **72**, 1101–8 (*Dec.* 1, 1947).—The anomalous positions of the lines originating with the rotational levels $K = 3$ are explained on the basis of a *K*-type splitting of these levels. The splitting is due to a 4th-order perturbation originating with the 1st-order correction terms to the moments of inertia, $I_{xx}^{(e)} = I_{yy}^{(e)}$ and the 1st-order Coriolis correction terms. The Pau exclusion principle permits only one of the two com ponents to be present. Thus, in the lower vibratio state, when J is even, only the lower component of th levels $K = 3$ is present, but when J is odd, only the uppe component is permitted. Similarly, for the upper vibra tion state, when J is even, only the upper component o the levels $K = 3$ may exist while for J odd, only the lowe component may exist. Since in this spectrum $\Delta J = \Delta K = 0$, the lines originating in levels where J is eve will be displaced to shorter wavelengths, while the line originating in levels where J is odd will be displaced t longer wavelengths. The agreement between computed shifts and measured shifts is satisfactory. A

535.343.4–14 : 539.133 58

Preliminary analysis of the microwave spectrum of SO_2. DAILEY, B. P., GOLDEN, S., AND WILSON, E. B., JR *Phys. Rev.*, **72**, 871–2 (*Nov.* 1, 1947).—32 lines have bee observed in the frequency range 20 000–30 000 Mc/s, o which only 5 can be attributed to transitions betwee states of moderately low J values of the $S^{32}O_2^{16}$ molecule the remaining lines must be attributed to other transi tions and other isotopic species of the molecule. Value of various quantities are deduced, including the Starl separation, the moment of inertia, and bond lengt and angle. W. E. D

535.343.4–14 : 539.133 58

Microwave absorption spectra of N_2O. COLES, D. K. ELYASH, E. S., AND GORMAN, J. G. *Phys. Rev.*, **72**, 97 (*Nov.* 15, 1947).—The rotational transition $J = 0$ to was examined for $N^{15}N^{14}O$ and $N^{14}N^{14}O$. The expecte triplet for the former was observed and gave a quadrupol coupling constant of $-0{\cdot}27$ Mc/s. A wide triplet wa observed for the second molecule, it being impossible t resolve the structure completely; moments of inertia an bond lengths for the molecules are deduced. W. E. D

535.343.4–15 : 539.132 58

The infra-red absorption spectrum and vibrationa frequency assignment of ketene. HARP, W. R., JR., AN RASMUSSEN, R. S. *J. Chem. Phys.*, **15**, 778–85 (*Nov.* 1947).—The spectrum has been determined from 2μ t 15μ and a complete frequency assignment deduced. Al the harmonic bands can be simply interpreted on thi assignment. The fine structure of the 925-cm^{-1} band i discussed. A

535.343.4–15 : 539.133 *see Abstr.* 690

535.343.4–15 : 551.521.3 58

The absorption spectrum of carbon dioxide from 1 to 16 microns. KAPLAN, L. D. *J. Chem. Phys.*, 15 809–15 (*Nov.*, 1947).—Absorption of a parallel beam o radiation by equivalent thicknesses of 0·004, 0·05, 1 4, and 20 cm of CO_2 is calculated on the basis of quan tum mechanics considerations for stratospheric condi tions. The intensity values for the vibration-rotationa lines in the *P* and *R* branches of the important vibrationa transitions are computed, and a method is suggested fo correcting the absorption values when more accurat measurements of the matrix element of the electric dipol moments of transition are made. An empirical formul suggested by Sutherland and Callendar is found to giv an inaccurate representation of the dependence o absorption on path length for conditions prevailing in th lower stratosphere. A

535.37 : 534.321.9 = 4 58

Sonoluminescence and its connection with certai chemical actions of ultrasonics. KLING, R. *Rev. Sci Paris*, **85**, 364–6 (*April* 1, 1947) *In French.*—After a revie

earlier work, an apparatus is described using a quartz illator working in the frequency range 403–983 kc/s. general characteristics of sonoluminescence are given, ether with the effect of acoustic pressure, exciting quency and temp. The effect of dissolved substances, osity and dipole moment are briefly mentioned, rence being also made to the spectral analysis of the iation. The relation with the oxidizing action of asonics is noted. G. F. H.

.37 : 548.7 586

haracteristic luminescence of crystal lattices. KUDVTZEVA, V. M. *C.R. Acad. Sci. URSS*, **52** (*No.* 6) 1–8 (1946).—Recent literature on u.v. luminescence at temps. is reviewed and the spectra of absorption and temp. luminescence of ZnO are compared; the latter resonance luminescence of the crystal lattice. The ctra for ZnS are also compared and the same conion is reached. It is suggested that the u.v. luminesce of CdS and CaO at low temps. is also a resonance ct. Thus the view is expressed that luminescence at temps. is not associated with either the presence of purities, or with the existence of imperfections in the ice. L. S. G.

.37.096 : 537.226.31.096 587

Dielectric losses and fluorescence of zinc silicate. GETI, G., AND NAGY, E. *Nature, Lond.*, **160**, 641–2 v. 8, 1947).—As the temp. is raised, the electrical nductivity of a Mn-activated Zn silicate rises at the ne time as the fluorescence (2 537 Å excitation) falls. quantitative explanation is given, assuming two types bsorbing centres, one of which is temp.-dependent and n-radiating, but contributes to the conductivity.

.371 = 3 588

Experiments on the luminescent excitation of ZnS–Cu light of long wavelength. RITSCHL, R. *Ann. Phys.*, z. (*Folge* 6) **1** (*Nos* 4–5) 207–18 (1947) *In German.*—It is own that light of wavelength within the luminescent ission band can excite ZnS–Cu to fluorescence and sphorescence. The phosphorescence so obtained ws a strong temperature-dependence with a marked imum at ~150°C. Photographs of spectra show antikes emission of the whole band in both fluorescence d phosphorescence. The results are discussed and ce with Riehl's ideas on crystalline phosphors. C. C.

.372 = 4 589

On the classification of the fluorescence bands of various anium salts. FREYMANN, M. *C.R. Acad. Sci., Paris*, 5, 529–31 (*Sept.* 29, 1947) *In French.*—The bands of acetate were classified by Pant and Sakhwalkar bstr. 2010 (1944)] in a different manner from that used the author [Abstr. 591 (1948)]. This is criticized, d to clear up the discrepancy a classification is now en of the fluorescence bands of the nitrate (with $_2O$), the chloride and the fluoride. The possibility the ion UO_2^{++} existing in two forms is discussed. L. S. G.

.372 + 535.343.2 = 4 590

On the complexity of the electronic spectra of salts of anium. FREYMANN, M., GUILMART, T., AND FREYNN, R. *C.R. Acad. Sci., Paris*, **223**, 545–7 (*Oct.* 7, 46) *In French.*—The salts concerned all have the group O_2 in their formula. An experimental study is made the absorption and fluorescence spectra of the sulphate, rate, hydroxide and acetate of uranium. The influence temperature and of water of crystallization is noted, d the possibility of observing an isotope effect is mened. The spectrum of the acetate, $(CH_3COO)_2UO_2 . I_2O$, is relatively simple. L. S. G.

535.372 + 535.375.5 = 4 591

Classification of the electronic bands of uranium acetate according to the infra-red and Raman frequencies. FREYMANN, M., GUILMART, T., AND FREYMANN, R. *C.R. Acad. Sci., Paris*, **223**, 573–5 (*Oct.* 14, 1946) *In French.*—A table of the emission and absorption bands is given [see Abstr. 590 (1948)]. L. S. G.

535.375.5 + 535.372 = 4 *see Abstr.* 591

535.375.5.096 592

Temperature variation of the second-order Raman spectrum of crystals. GROSS, E., AND STEHANOV, A. *Nature, Lond.*, **160**, 568–9 (*Oct.* 25, 1947).—The low-frequency part of the spectrum was found to be much more temp.-dependent than the high-frequency part. Spectra from a rock salt crystal at 250° and 700°c are shown as an example. An explanation is offered, depending on the different temp.-dependence of the difference-combination vibrations from the octave and sum-combination vibrations.

535.376 : 539.164.08 *see Abstr.* 729

535.39 : 621.392.22 = 3 593

The analogy between angle of incidence and frequency problems. CREMER, L. *Arch. elekt. Übertragung*, **1**, 28–47 (*July–Aug.*, 1947) *In German.*—[Abstr. 668 B (1948)].

535.417 594

A wavefront-shearing interferometer. BATES, W. J. *Proc. Phys. Soc., Lond.*, **59**, 940–50 (*Nov.*, 1947).—A new type of interferometer is described by means of which the asphericity of an optical wavefront can be measured, by testing it against itself with lateral displacement or shear. Continuous control of the amount of this shear, and of the meridional or sagittal fringes is obtained in white light. A.

535.417 : 539.211 595

A transparent-replica technique for interferometry. FAUST, R. C., AND TOLANSKY, S. *Proc. Phys. Soc., Lond.*, **59**, 951–7 (*Nov.*, 1947).—The technique allows the surface of an opaque body to be examined interferometrically using the transmitted multiple-beam fringe pattern. This avoids the difficulties inherent in the technique of reflected fringes. A replica made from methyl methacrylate polymer is found to reproduce features both in extension and in depth to within close limits. Contours of only 40 Å in height are faithfully reproduced, and it is considered that a 10 Å change would be copied. The replica shows an overall shrinkage of ~½%. The technique is tested on glass, mica and calcite, and applied to the examination of a coarsely polished metal surface. Phase-effect errors are eliminated entirely. A.

535.42 : 539.215.2 : 537.531 *see Abstr.* 656

535.42 : 621.392 : 538.56 *see Abstr.* 682

535.43 : 615.849 : 537.531 *see Abstr.* 657

535.5 : 530.145.6 *see Abstr.* 527

535.5 : 539.13 : 535.343.2–15 *see Abstr.* 575

535.66 : 541.651 *see Abstr.* 772

535.66 : 548.0 : 535.343.2 *see Abstr.* 574

535.822.5 596

A microscope for visual colour microscopy in the ultraviolet rays. BRUMBERG, E. M. *C.R. Acad. Sci. URSS*, **52** (*No.* 6) 499–502 (1946).—The instrument is described. The image of the preparation formed by u.v. is projected on to a fluorescent screen where it is examined in fluorescent light through a second microscope. 3-colour and 2-colour methods for using the instrument are given. L. S. G.

HEAT 536

536.21 : 534.113 *see Abstr.* 554

536.212.098 + 537.323.098 + 537.312.8 = 3 *see Abstr.* 647

536.212.3.08 597

A modified Fitch thermal conductivity apparatus. HARVALIK, Z. V. *Rev. Sci. Instrum.*, **18**, 815–17 (*Nov.*, 1947).—A thermal conductivity apparatus based upon the increase of temperature of a receiver by heat transferred through the sample is described, and its modification to samples inclined to the horizontal. The temperature changes of the receiver are measured with thermocouples, the reference junction of which is at room temperature. A.

536.24.01 598

Heat transfer to molten metals. MARTINELLI, R. C. *Trans. Amer. Soc. Mech. Engrs*, **69**, 947–59 (*Nov.*, 1947).—The paper is based on an extension of the analogy between heat and momentum transfer. The turbulent-flow field is divided into a laminar sublayer, a buffer layer, and a turbulent core. The thermal resistances of the laminar sublayer and the buffer layer are calculated, but the thermal resistance of the turbulent core is re-evaluated for very low values of the Prandtl modulus (molten metals) by considering the simultaneous transfer of heat by molecular conduction and eddy diffusion. The relative importance of the thermal resistances of the laminar sublayer, buffer layer, and turbulent core is discussed and the temperature distribution in the fluid is evaluated for various values of the Prandtl modulus. The unit conductance for convective heat transfer $\propto$ (friction factor)$^{\frac{1}{2}}$. A.

536.33 : 535.231.4 : 537.583 = 4 599

Measurement of the thermal emissivity of oxide cathodes. CHAMPEIX, R. *C.R. Acad. Sci., Paris*, **225**, 728–9 (*Oct.* 27, 1947) *In French.*—Two measurements of brightness temperature and the corresponding heating power suffice to determine the thermal emissivity. Values between 0·07 and 0·26 were found; further investigations are being made in the hope of finding a correlation between the emissivity and the degree of activation. A. H. W. B.

536.413 : 669.35 600

Thermal expansion of some copper alloys. HIDNERT, P., AND KRIDER, H. S. *J. Res. Nat. Bur. Stand., Wash.*, **39**, 419–24 (*Nov.*, 1947).

536.422 : 537.533.9 *see Abstr.* 661

536.422.15 : 536.7 : 548.528 = 3 *see Abstr.* 775

536.424.1 : 536.77 : 536.62 *see Abstr.* 608

536.46 = 3 601

Non-independent flames and their ignition. MACHE, H. *Acta Phys. Austriaca*, **1** (*No.* 1) 74–88 (1947) *In German.*—[See Abstr. 3510 (1947)].

536.462 : 541.126 *see Abstr.* 766

536.468 : 537.521.7 602

Ignition of explosive gas mixtures by electric sparks. I. Minimum ignition energies and quenching distances of mixtures of methane, oxygen, and inert gases. BLANC, M. V., GUEST, P. G., VON ELBE, G., AND LEWIS, B. *J. Chem. Phys.*, **15**, 798–802 (*Nov.*, 1947).—An apparatus and experimental procedure is described for measuring capacitances and gap voltages. The calculated minimum ignition energies are independent of gap voltage. With increasing gap length they attain a minimum at critical distances which mark the farthest penetration of the flame-quenching effect of the electrode material. Above the quenching distances the energies remain constant over some range which is governed by mixture composition and pressure. Energies measured in this rang may be regarded as absolute minimum energies. Da are presented for mixtures at room temp. and pressure ranging from 0·2 to 1 atmosphere.

536.468 : 537.521.7 60

Ignition of explosive gas mixtures by electric sparks II. Theory of the propagation of flame from an instantaneou point source of ignition. LEWIS, B., AND VON ELBE, G *J. Chem. Phys.*, **15**, 803–8 (*Nov.*, 1947).

536.48 60

On the nature of "suprafluid" helium II. BENEDICKS, C *Ark. Mat. Astr. Fys.*, **35 A** (*Paper* 10) 21 *pp.* (1947).— The author recalls his (1912) theory of allotropy an applies its principles to the case of liquid He II. H claims that an allotropic transformation at the λ-point arising from the ionization of the He atoms by friction electricity at the vessel wall, is able to give a satisfactor qualitative explanation of all the properties of liquid He II

536.48 : 538.222 *see Abstr.* 678

536.581 : 621.316.74 60

Proportioning temperature controller. LAZARUS, D AND LAWSON, A. W. *Rev. Sci. Instrum.*, **18**, 730– (*Oct.*, 1947).—[Abstr. 550 B (1948)].

536.581 : 621.316.74 : 621.315.554 60

Electrical snap-action temperature controls for aircraf CAMPBELL, J. R. *Trans. Amer. Soc. Mech. Engrs*, 69 821–7 (*Nov.*, 1947).—A new bimetallic strip thermosta is described, having a temperature differential of 2° a single-pole double-throw contact arrangement, wt. 1 oz and a rating of ½ h.p. at 110–220 V a.c. The contac mechanism is designed for toggle action, which results i high stability under vibration. The units can be mad for use between −100° and 600°F. It is shown how thei characteristics can be calculated from the design data The life of these thermostats is largely governed by th properties of the contacts; the remaining parts of th mechanism do not deteriorate appreciably during use. H. K. H

536.62 : 536.77 60

Specific heat, enthalpy, and entropy of uranyl fluoride WACKER, P. F., AND CHENEY, R. K. *J. Res. Nat. Bur Stand., Wash.*, **39**, 317–20 (*Oct.*, 1947).—The hea capacity was measured from 13–418°K by using vacuum-type calorimeter equipped with thermostate radiation shields. From the data so obtained, th enthalpy $H^\circ - H_0^\circ$ was calculated to be 63·96, 77·62 and 108·15 int. joules/g at 298·16°, 338·16°, an 423·16°K, respectively, and the entropy to be 0·4400 0·4830, and 0·5635 int. joules/deg.-g at the sam temperatures. No evidence of a transition was found The values of the sp. ht., enthalpy, entropy, and fre energy are tabulated at 5-deg. intervals of temperature. A.

536.62 : 536.77 : 536.424.1 60

Heat capacities at high temperatures of uranium uranium trichloride, and uranium tetrachloride. GINNINGS D. C., AND CORRUCCINI, R. J. *J. Res. Nat. Bur. Stand Wash.*, **39**, 309–16 (*Oct.*, 1947).—The enthalpies referre to 0°C of U in the range 0–900°C, of UCl_3 in the rang 0–725°C, and of UCl_4 in the range 0–425°C, have bee determined using the "drop" method with an ice calori meter [Abstr. 3521 (1947)]. Derived values of entrop referred to 0°C and sp. ht. are given. The samples wer of high purity. Two first-order transformations of U were observed and the heats of transition calculated fro the experimental data. No evidence of first- or second order transitions in the chlorides was found. A

536.631 : 539.11 *see Abstr.* 685

.632 + 536.655 609

Measurements of heat of vaporization and heat capacity a number of hydrocarbons. OSBORNE, N. S., AND NGS, D. C. *J. Res. Nat. Bur. Stand., Wash.*, **39**, –77 (*Nov.*, 1947).—Using a new calorimeter, accurate asurements have been made of the heat capacities of ve hydrocarbons in the range 5° to 45°c, and of the ts of vaporization of fifty-nine hydrocarbons at 25°c. ese hydrocarbons, having from 5 to 10 carbon atoms molecule, include 35 paraffins, 3 alkylcyclopentanes, alkylcyclohexanes, and 11 alkylbenzenes. A.

5.654 : 535.338.4 : 539.13 *see Abstr.* 687

5.655 + 536.632 *see Abstr.* 609

THERMODYNAMICS 536.7/.8

5.7 = 4 610

On the thermodynamics of some irreversible processes. Simple bodies. II. Thermal diffusion and connected enomena. DE GROOT, S. R. *J. Phys. Radium (Sér. 8)* 188–90 (*June*): 193–200 (*July*, 1947) *In French.*—The rmodynamics of irreversible processes, based on the iprocal relations of Onsager, is developed for a simple stem in which there are transfers of energy and matter d the reciprocal relations between these transfers is nsidered. In the second paper the theory is developed r a mixture of substances in which occur irreversible ocesses such as thermal conduction, diffusion and nduction of electricity with interactions between them. F. E. H.

6.7 : 536.422.15 : 548.528 = 3 *see Abstr.* 775

6.71 = 4 611

Remarks on the subject of the equation of state of ids. MILOSAVLJÉVITCH, D. *C.R. Acad. Sci., Paris*, **5**, 671–3 (*Oct.* 20, 1947) *In French.*—A new equation ' state is sought in which the constants are to be the ts constant, critical pressure volume and temp., the mp. and volume at the triple point, the latter having ree values. All the terms of the equation are to be mensionless and the natural function e^x is to play a incipal role. It is found that for CO_2 and C_6H_{12} the turation curve may be written $[\ln RT/p v] : (1 - p v/RT) \cdot 1 = v_k/(T) v$, where v_k is the critical volume. If u' d u'' denote the L.H.S. of this equation for the liquid id vapour phases at saturation where the volumes are and v'', it follows that $u'/u'' = v''/v'$. The verification f these equations by comparison with experimental sults is stated to be satisfactory. No data are given. F. E. H.

536.77 : 536.424.1 : 536.62 *see Abstr.* 606

536.77 : 536.62 *see Abstr.* 607

536.8 : 621.43 612

The derivation of variable specific heat expressions for hermal efficiency and calorific values of working fluid. for se in internal combustion engine design. ROGERS, C. *hil. Mag.*, **38**, 134–49 (*Feb.*, 1947).—The mathematical erivation of the expressions is given. This is rather edious but the results are useful in determining the limensions of cylinders for engines of a given power. L. S. G.

ELECTRICITY 537

537.12 = 3 613

Electron field-theory. FLAMM, L. *Öst. Ingen. Arch.*, , (*Nos* 4–5) 353–71 (1947) *In German.*—The electron is egarded as the "matter" of the electric field and each one is supposed to fill all space. Basic equations for the electric field are given and these are analogous to those nolding in the theory of hydromechanics. But hydrodynamics is a mechanics of points, electrodynamics a mechanics of lines. This theory is developed and some special fields are studied. L. S. G.

537.12 : 539.166.835 *see Abstr.* 734

537.122 : 530.145.6 = 4 614

The problem of the polarisation of the de Broglie waves associated with electrons. BRENET, J. *Rev. Sci., Paris*, **85**, 357–9 (*April* (), 1947) *In French.*—A discussion of the polarization of photons and electrons suggests that only composite particles can be polarized but not elementary particles. G. J. K.

537.122 : 531.18 : 530.12 *see Abstr.* 517

537.122 : 539.152.1 *see Abstr.* 691

537.122.08 : 621.385.15 : 621.318.572 615

An improved electron multiplier particle counter. ALLEN, J. S. *Rev. Sci. Instrum.*, **18**, 739–49 (*Oct.*, 1947).—[Abstr. 608 B (1948)].

537.133 : 537.534 *see Abstr.* 662

537.133 : 539.152.2 *see Abstr.* 698

537.133 : 539.172 *see Abstr.* 739

537.133 : 539.185 : 539.172.1 *see Abstr.* 742

537.133 : 539.185 : 539.172.2 *see Abstr.* 743

537.221 616

Electric charge produced by rime on iced surfaces. CLAY, J., AND KRAMER, C. *Physica, 's Grav.*, **13**, 508–16 (*Sept.*, 1947).—The variation of the contact potential of water, ice and hoarfrost to air was measured. The electric charge on a cylindrical vessel cooled internally by means of a solid cylinder at low temp. was studied in an air current, hoarfrost meanwhile being formed on the vessel surface. The average rate of charge per cm^2 of surface was initially 4×10^{-16} coulomb/sec. The max. potential reached was + 80 mV and after hoarfrost formation the cylinder becomes negatively charged down to a min. of − 500 mV. After about 10 min no increase was found. Large positive changes were found by adiabatic expansion. A.

537.226 617

The dielectric relaxation of mixtures of dipolar liquids. SCHALLAMACH, A. *Trans. Faraday Soc.*, **42 A**, 180–6; *disc.*, 193–4 (1946).—Curves of dielectric constants against temp. for binary mixtures show single maxima in the case of two associated or two non-associated liquids. A mixture of an associated and a non-associated liquid may, however, give 2 separate peaks of loss factor. The suggested explanation is that the process of relaxation involves the disturbance of regions considerably larger than that corresponding to the volume of an individual molecule, and that a mixture of associated and non-associated liquids is not microscopically homogeneous. H. G. M. S.

537.226 618

Comments on "Theory of the ferroelectric effect and clamped dielectric constant of Rochelle salt." MASON, W. P. *Phys. Rev.*, **72**, 976 (*Nov.* 15, 1947).—A modified model [Abstr. 324 (1948)] is proposed whereby a vanishing ferro-electric effect is obtained near absolute zero with a non-vanishing dipole moment. W. E. D.

537.226 : 537.529 *see Abstr.* 651

537.226 : 538.569.3 619

Experimental curves of losses and of anomalous dispersion as a basis of a spectral method. GIRARD, P., AND ABADIE, P. *Trans. Faraday Soc.*, **42 A**, 40–7; *disc.*, 75–8 (1946).—Curves of dispersion and loss against λ (cm and m regions) for a number of crystalloids, colloidal media and substances containing free and bound water

show variations among themselves and divergencies from the theoretical curves. Assumptions that the polar molecules in the medium are not all necessarily identical, of spherical shape nor separated from each other will, it is argued, help to account for these discrepancies. Hence the necessity, in using the spectral method, for recording these curves over the widest possible λ range, and at constant temperatures. H. G. M. S.

537.226 : 621.3.011.5 = 4 620

Dielectric properties of water, heavy water and electrolytic solutions at high frequencies. RITSON, D. M., HASTED, J. B., AND COLLIE, C. H. *C.R. Acad. Sci., Paris*, **225**, 285–7 (*Aug.* 4, 1947) *In French.*—The properties are measured at wavelengths of 1·25–10 cm and at various temperatures. The results are examined in the light of the theories of Debye and his associates. E. R.

537.226.1 621

The distribution of relaxation times in dielectrics. GARTON, C. G. *Trans. Faraday Soc.*, **42 A**, 56–60; *disc.*, 75–8 (1946).—An attempt to account for the substantially constant loss angle over a very wide range of frequencies, such as is characteristic of good dielectrics. As, fundamentally, any limited distribution of time constants must lead to results in accordance with the Debye equations, a constant loss angle demands a distribution extending beyond the whole range of constancy. It is assumed that there exists an exponential distribution of temporary "thermal wells" and that oscillations of dipoles or ionic elements take place between them and the "permanent wells" associated with the individual molecular structure. Such a mechanism would give rise to a loss angle constant with frequency. H. G. M. S.

537.226.1 622

A note on the analysis of dielectric measurements. WHITEHEAD, S. *Trans. Faraday Soc.*, **42 A**, 66–75; *disc.*, 75–8 (1946).—Present dielectric theories usually lead to approx. linear phenomena, giving rise to rotation and relaxation spectra ranging from very high to low frequencies. As dielectric constant, loss angle and absorption current are interrelated, equivalent results can be inferred from the study of any one, while a comparison of them may eliminate common parameters. The employment of various time-dependent fields has particular applications, especially where unidirectional fields of short duration are required, and for the study of discontinuous non-linear phenomena such as discharges. H. G. M. S.

537.226.1 623

Dielectric absorption in benzene and liquid paraffin solutions at ultra high frequencies. JACKSON, W., AND POWLES, J. G. *Trans. Faraday Soc.*, **42 A**, 101–8; *disc.*, 155–70 (1946).—Using lumped circuits and resonant cavities, details of which are described, curves of tan δ against solution concentration and of incremental tan δ against frequency were plotted for benzophenone, nitrobenzene, brombenzene, chloroform and acetone in benzene solution at frequencies from 10^5–10^{10} c/s. Single relaxation times were observed which conformed to the Debye theory and dipole moment values which agreed with those obtained by refractive index measurements. Similar experiments on benzophenone in paraffin solution revealed a spectrum of relaxation times, though the value of dipole moment agreed within 1½%. The relaxation and viscosity ratios did not correspond. H. G. M. S.

537.226.1 624

Dielectric properties of water. COLLIE, C. H., RITSON, D. M., AND HASTED, J. B. *Trans. Faraday Soc.*, **42 A**, 129–36; *disc.*, 155–70 (1946).—An account of measurements carried out at $\lambda = 10$ and 1·26 cm over the range 0°–100°C. Two alternative methods for the 10 cm work are described, and close detail is given of the 1·26 cm water cell. Measured values are given in the form of components of the complex propagation constant. Discussion of the results is meagre but the curve of the exponential absorption constant against temp. at 1·26 cm is given. It shows a peak at ~ 15°C which corresponds in position, but not sharpness, with the results of Saxton and Lane. H. G. M. S.

537.226.1 625

Dipole orientation in solutions of esters in polyisobutene and polythene. PLESSNER, K. W., AND RICHARDS, R. B. *Trans. Faraday Soc.*, **42 A**, 206–13; *disc.*, 220–3 (1946).—Power factor frequency curves of solutions of dioctylphthalate and other esters were taken at various temperatures and showed maxima at radio frequencies, the breadth of the curves indicating a distribution of relaxation times. The more rapid decrease with rising temperature in the case of polythene was attributed to its partially crystalline structure. Values of dipole moments and activation energies of dipole orientation are derived. The behaviour of polystyrene mixtures is compared, the difference being attributed to a different mechanism of dipole orientation. H. G. M. S.

537.226.1 626

Measurements of the dielectric properties of ice. LAMB, J. *Trans. Faraday Soc.*, **42 A**, 238–44; *disc.*, 244–53 (1946).—Describes measurements: (*a*) at 10^{10} c/s over the temperature range 0° to − 40°C using an H_{01} cavity resonator; and (*b*) at − 5°C over the frequency range 8 kc/s–1·25 Mc/s using a Hartshorn and Ward dielectric test set. The constant value of permittivity at 10^{10} c/s is consistent with the curve shown at the lower frequencies where a steady value is reached with rising frequency at ~ 4×10^5 c/s. It is, however, impossible to reconcile the max. value of loss factor, occurring at $3 \cdot 5 \times 10^4$ c/s, with that obtained at 10^{10} c/s and − 5°C. The possibility of a second absorption max. above 10^{10} c/s or of impurities in the ice is suggested as the cause of the discrepancy. H. G. M. S

537.226.1 : 538.569.3 627

Measurements on the absorption of micro-waves. I WHIFFEN, D. H., AND THOMPSON, H. W. *Trans. Faraday Soc.*, **42 A**, 114–22; *disc.*, 155–70 (1946).—Describes measurements carried out at $\lambda = 1 \cdot 27$ and 3·26 cm on rigid molecule solutes in benzene, using an H_{10} wave guide for the shorter and an H_{01} cavity resonator for the longer λ. From the 2 measurements of tan δ the relaxation times and dipole moments were computed using the Debye formula, the results showing fair agreement with accepted values. Further tests carried out on long-chain molecules including a dipole gave low values for calculated dipole moments, suggesting that the Debye equation calls for some modification in the case of non-rigid solutes. Similarly experiments carried out with solutions in cyclohexane and a paraffin showed no proportionality between relaxation time and viscosity with an increasing percentage of paraffin. H. G. M. S

537.226.1 : 538.569.3 628

Measurements on the absorption of microwaves. II WHIFFEN, D. H., AND THOMPSON, H. W. *Trans. Faraday Soc.*, **42 A**, 122–9; *disc.*, 155–70 (1946).—Measurements of tan δ were made from − 80° to + 80°C at $\lambda = 1 \cdot 27$ cm on solutions of polar solutes in non-polar solvents and of pure liquids of small polar moments. Curves of tan δ and temperature × specific loss tangent against temperature are shown, and the derived dipole moments and relaxation times are in reasonable agreement with those

tained from measurements at two wavelengths. nother approach to the consideration of relaxation, tributed to Eyring, is discussed. H. G. M. S.

7.226.1 : 538.569.3 629

Extension of the measurements of dispersion and sorption by liquids to the region of centimetric radio-ctric waves. ABADIE, P. *Trans. Faraday Soc.*, **42 A**, 3–9; *disc.*, 155–70 (1946).—The measurements were rried out at $\lambda = 3$, 6, 11 and 18 cm, using a short-rcuited co-axial line and the dispersion and absorption rived from plots of the standing waves. Curves tained for benzene, acetone, water, nitrobenzene and rmal propyl alcohol differ in most cases from eoretically derived curves, and accordingly extrapola-n from the experimental results cannot be supported. H. G. M. S.

7.226.1 : 538.569.3 630

Some measurements on the absorption of centimetric aves by liquid dielectrics. CRIPWELL, F. J., AND UTHERLAND, G. B. B. M. *Trans. Faraday Soc.*, **42 A**, 49–52; *disc.*, 155–70 (1946).—An account of measure-ents carried out at $\lambda = 1{\cdot}25$ and $3{\cdot}25$ cm on a number dilute solutions of polar liquids in benzene. The uid cell was located vertically at the end of a wave ide and values of tan δ were derived from standing ave measurements. From these figures values of laxation times and dipole moments were calculated ing the Debye theory. Results were generally in good greement with published figures and, it is suggested, ther more reliable than those of Whiffen and Thompson Abstr. 627–8 (1948)] because of the absence of uncertainty reflection coefficients at interfaces. The estimated rors were 3–5%. H. G. M. S.

37.226.1 : 538.569.3 : 532.133 631

Waveguide measurements of dielectric absorption of olutions of polar substances in non-polar solvents. HALL, I. W., HALLIDAY, I. G., JOHNSON, W. A., AND WALKER, . *Trans. Faraday Soc.*, **42 A**, 136–43; *disc.*, 155–70 946).—The object of the tests was to investigate the riation of dielectric loss with viscosity, the latter being aried by the employment of 2 component mixtures of ifferent viscosities for the non-polar solvents. The lectrical tests were carried out at $\lambda = 5{\cdot}08$ cm and iscosity was measured with vertical capillary efflux type iscometers. The curves, at constant temperature, of bsorption v. log viscosity, for nitrobenzene as the solute, howed maxima varying in value and position on the iscosity scale with the type of low viscosity component sed, suggesting that the Debye relation for relaxation ime and internal friction cannot be applied without odification. H. G. M. S.

37.226.1 : 541.183.56 632

Preliminary observations of the dielectric constants of apors adsorbed on activated silica. MCINTOSH, R., OHNSON, H. S., HOLLIES, N., AND MCLEOD, L. *Canad. . Res. B*, **25**, 566–74 (*Nov.*, 1947).—The change in the apacity of an electrical capacitor was measured when easured amounts of ethyl chloride, *n*-butane, and thylene oxide were adsorbed on silica gel situated etween the plates of the condenser. The plot of capacity hange v. amount adsorbed was found, in all cases, to onsist of two or more quite distinct sections, each pproximating to linearity. The temp. coeff. of dielectric onstant were evaluated. The dielectric constant cal-ulated for adsorbed *n*-butane was close to that calculated or the bulk liquid, whereas the value calculated for dsorbed ethyl chloride was significantly lower than the alue calculated for the liquid. A.

537.226.1 : 541.64 633

The dielectric properties of high polymers. RICHARDS, R. B. *Trans. Faraday Soc.*, **42 A**, 194–7; *disc.*, 220–3 (1946).—A review of some features of these properties and their use in the study of polymer structures and characteristics. The limitations to the correlation of activation processes and relaxation times with macroscopic processes are discussed and the possible causes of the inherent spread of relaxation times enumerated. Mention is made of a method of interpreting the dielectric properties of filled polymers using Wagner–Maxwell equations. H. G. M. S.

537.226.1 : 541.64 634

The dielectric properties of chlorinated polythenes at radio frequencies. OAKES, W. G., AND RICHARDS, R. B. *Trans. Faraday Soc.*, **42 A**, 197–205; *disc.*, 220–3 (1946).—Two series of these materials, prepared by hot and cold processes and containing varying percentages of Cl, were examined for permittivity and power factor at room and higher temperatures and at frequencies from 10^5–10^8 c/s. An increase in the average dipole relaxation time with increase in Cl, indicated by the decrease in frequency at which the power factor peak occurs, is in accord with a change of the material from a flexible to a rigid state. The possible presence of $-CCl_2-$ or $-CHCl-CHCl-$ groups, suggested by calculated average dipole moment values, and the distribution of Cl atoms within the polymer molecules are discussed. H. G. M. S.

537.226.1 : 621.315.61.08 635

The representation of dielectric properties and the principles underlying their measurement at centimetre wavelengths. JACKSON, W. *Trans. Faraday Soc.*, **42 A**, 91–101; *disc.*, 155–70 (1946).—Following a correlation of the parameters used, the resonance method of measurement is described. The lumped resonant circuit, the coaxial line and the preferred types of cavity resonators are compared and the respective max. values of Q attainable, the appropriate frequency ranges, physical dimensions and the arrangement of specimens for measurement given. An analysis is also supplied for the standing wave method of measurement which, it is maintained, is inferior in accuracy to the resonance method. The different parameters used by other authors are reconciled. H. G. M. S.

537.226.1 : 621.315.612 636

Some measurements of the permittivity and power factor of low loss solids at 25 000 Mc/sec frequency. PENROSE, R. P. *Trans. Faraday Soc.*, **42 A**, 108–14; *disc.*, 155–70 (1946).—The equipment used consisted of a klystron oscillator feeding an H_0 cylindrical resonator and a crystal detector. Fifteen materials were measured, including plastics, glasses and ceramics. Flat circular discs of the dielectrics were placed at one end of the resonator and the reduction of resonant length gave the permittivity while tan δ was deduced from the damping of the resonance. Complete analyses are given for both measurements and the accuracies were of the order of 2% and 5% respectively. H. G. M. S.

537.226.2 : 621.317.37 637

Measurements on the dielectric constant of carbon dioxide as a function of pressure and temperature. VAN ITTERBEEK, A., AND DE CLIPPELEIR, K. *Physica, 's Grav.*, **13**, 459–64 (*Sept.*, 1947).—An electrostatic method was used on CO_2 between 1 atm. and 16 atm. at 0°, 11°, 25°, 40°, 50° and 100°C. The accuracy for the polarization is 0·01%. Polarization was found to possess a max. at 40°C. Measurements were also made on gas mixtures: $CO_2 - O_2$, $CO_2 - CO$ and $O_2 - H_2$ confirming previous measurements. A.

537.226.31.096 : 535.37.096 *see Abstr.* 587

537.226.8 638

On the frequency dependence of the dielectric constant in dipolar solids. SACK, R. A. *Trans. Faraday Soc.*, **42 A**, 61–6; *disc.*, 75–8 (1946).—The Debye formula, which expresses the a.c. dielectric constant for dipolar solids in terms of the value at very low and high frequencies, a relaxation time and a frequency, does not agree wholly with experimental results in the case of solids. These discrepancies might be explained by means of a short range interaction between neighbouring dipoles. Quantitative consideration of the one-dimensional problem shows that the Debye formula still applies, but whether a study of interactions in 2 or 3 dimensions would reveal the source of the discrepancies is left open. H. G. M. S.

537.226.8 : 621.315.61 639

Power factor and temperature coefficient of solid (amorphous) dielectrics. GEVERS, M., AND DU PRÉ, F. K. *Trans. Faraday Soc.*, **42 A**, 47–55; *disc.*, 75–8 (1946).—Most of the technically important solid dielectrics are either of the amorphous type or else they consist of a crystalline mass containing many lattice irregularities and impurities. They are generally characterized by having (*a*) a permittivity varying only slightly with frequency; (*b*) a power factor also almost independent of frequency; and (*c*) a ratio of temperature coefficient of permittivity to power factor of nearly always the same value. Because of the amorphous nature of these substances, a statistical scattering of the activation energies involved in the excitation of dipoles and displacement of ions can be assumed. On this basis an analysis is carried out, the results of which support the 3 characteristics stated above. H. G. M. S.

537.226.8 : 621.396.619.13 : 621.315.612.011.5 640

Effect of field strength on dielectric properties of barium strontium titanate. DONLEY, H. L. *RCA Rev.*, **8**, 539–53 (*Sept.*, 1947).—[Abstr. 522 B (1948)].

537.228.1 : 548.5 = 4 *see Abstr.* 774

537.228.1/.2 641

Piezoelectric effect in polycrystalline barium titanate. CHERRY, W. L., JR., AND ADLER, R. *Phys. Rev.*, **72**, 981–2 (*Nov.* 15, 1947).—It was found that under certain conditions there was a residual electromechanical effect after removal of the field. In the most favourable case this could be as high as 85% of the effect when the field was applied. Effects produced by various fields and length of time of application are given. W. E. D.

537.228.2 642

Electrostrictive effect in barium titanate. MASON, W. P. *Phys. Rev.*, **72**, 869–70 (*Nov.* 1, 1947).—The thickness mode of vibration is identified with a very high electromechanical couple and is explained in terms of an electric domain theory. Deductions from experiment show that 7·5% of the domains are aligned by a field of 30 kV/cm. W. E. D.

ELECTRIC CURRENTS 537.3

537.311.33 = 3 643

The temperature dependence of the resistivity of semiconductors. GISOLF, J. H. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 1–3) 3–26 (1947) *In German.*—A new model for the energy structure of an electronic semi-conductor is proposed in which electron donor levels are situated *above* the lowest level of the conduction band in the case of an excess semi-conductor. These levels are normally completely dissociated. In addition, it is assumed that a whole band of electron traps exists immediately below the conduction band and is normally partially filled. The concentration of free conduction electrons is shown to be a very critical function of the relative concentration and energy difference of donors and traps, thus accounting for the wide range of conductivities observed in practice. The arguments developed are also applicable to a deficit semi-conductor. It is shown how a model of this type explains the existence of conductivity minima as well as maxima, and the observed relation (at a fixed temperature) between the conductivity and the apparent activation energy (Meyer's rule.) H. K. H.

537.312.5 = 3 644

The effect of secondary electrons on photo-conduction. POHL, R. W., AND STÖCKMANN, F. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*No.* 6) 275–84 (1947) *In German.*—It is shown that saturation currents in photo-conducting crystals can only be obtained if the dark-current is at least partially ionic. In this case the non-uniform illumination of the crystal produces local increases of field strength which affect the ionic current only slightly but increase the electron current by a large factor. This secondary current can exceed the primary current substantially. A simple equation for the variation of current with the applied voltage is derived. H. K. H.

537.312.5 : 535.215.1 645

Photogalvanic effect in metals. KIRVALIDZE, I. D. *C.R. Acad. Sci. URSS*, **52** (*No.* 6) 491–4 (1946).—Experimental apparatus is described which allows the photogalvanic effect to be observed. Results are reported relating to Pt, Ni, Al and Zn. The positive charge of the metal surface, imparted to it by ultra-violet irradiation, is due to the external photoelectric effect and also the ejection of electrons from the surface into the interior of the metal. L. S. G.

537.312.6 = 3 646

Pressure and temperature coefficient of the electrical resistivity of some alloys. I. Introductory experiments. EBERT, H., AND GIELESSEN, J. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 4–5) 229–40 (1947) *In German.*—The pressure coefficients of the resistivity of a number of Cu, Ni, Pt, Au and Ag alloys, also of "Invar," "Thermostan," "Manganin," and "Urdox," were investigated up to about 20 000 atmospheres. The observed values are $\sim 10^{-6}$/atmos. and can be of either sign. The results show a negative correlation between the temp. and pressure coefficients. H. K. H.

537.312.62 : 538.242 *see Abstr.* 680

537.312.8 + 537.323.098 + 536.212.098 = 3 647

Investigations on antimony single crystals in a transverse magnetic field. (Electric and thermal resistance; thermal e.m.f.) RAUSCH, K. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 4–5) 190–206 (1947) *In German.*—Single crystals of Sb ~ 7 cm long, 0·4 cm thick, fitted with a heating coil and two constantan-manganin thermocouples ~ 3 cm apart, were investigated in an apparatus described by Grüneisen and others [Abstr. 2615 (1938), 1861 (1941)]. Rods of various orientations ($P \equiv c$ || axis; S || $\equiv c \perp$ axis, a || axis; $S \perp \equiv c$ and $a \perp$ axis) were used at temps between $-193°$ and $+25°$C and in transverse fields of 0 to 10 000 gauss. With the symbols H = magnetic field, ρ = specific resistance, R = resistance, R_0 = resistance for $H = 0$, $\Delta R = R - R_0$, r = (resistance at $t°$)/(resistance at 0°C), θ = azimuth in plane $\perp$ to rod axis, the main results are: (*a*) At 0° ρ || $= 2{\cdot}626 \times 10^{-5}$, $\rho \perp 3{\cdot}601 \times 10^{-5}$ ohm cm, $d \log\rho/dt \simeq 5 \times 10^{-3}$. (*b*) At $\sim -190°$, R increases by $\sim 50\%$ for $H = 10\,000$. For P crystals, ΔR has six maxima as θ varies from 0 to π, the amplitude of variation being $\sim 10\%$; for S crystals there are two peaks with amplitude $\sim 40\%$.

$\Delta R/R_0$ approx. $\propto (H/r)^{1\cdot57}$ (Kohler's relation). The thermal resistance behaves qualitatively like the ctrical, but the variations are smaller. On certain umptions the measured thermal resistance can be ided into a lattice part and an electron part. (*e*) The rmal e.m.f. against constantan varies $\sim 1\,\mu$V at 190° when H is increased from 0 to 10 000. The iation depends on θ somewhat as the conductivities but for $S\|\|$ crystals the minima are shifted by 43°. explanation is suggested. A. J. C. W.

7.323.098 + 536.212.098 + 537.312.8 = 3 *see Abstr.* 647

ECTRIC DISCHARGES AND RADIATIONS 537.5

7.521.7 : 536.468 *see Abstr.* 672–3

7.525.8 : 538.561 = 4 648

The production of high frequency energy in ionised es in a magnetic field. STEINBERG, J.-L. *Rev. Sci., ris,* **85,** 601–6 (*June* 1 *and* 15, 1947) *In French. Summary Nature, Lond.,* **160,** 833–4 (*Dec.* 13, 1947).—Electrical charges in N_2, 14–20 μ pressure, 500–3 000 V, 10 cm ctrode spacing, were studied. Radiation (λ 1·3–2·6 m) s detected only in the presence of magnetic fields. perimental data are presented in detail. J. D. C.

7.525.83 = 3 649

The dependence of the normal cathode fall upon the rface condition of the cathode. I. SEELIGER, R., AND RTHOLOMEYCZYK, W. *Ann. Phys., Lpz.* (*Folge* 6) **1** *Jos* 4–5) 241–50 (1947) *In German.*—Measurements of rmal cathode falls were made, with great attention to tails of technique, in Ne with Fe electrodes. The fects caused by the use of hot electrodes and by the mission of foreign gases in small amounts from a ated Fe wire are described. J. D. C.

7.527.5 : 535.33 = 3 650

Electrical discharge in inert gases at high pressures.) Discharge characteristic and spectral properties of high essure discharges in inert gases. (II) Spectral line, ntinuous, and total radiation as functions of pressure d current strengths. Discussion of results. SCHULZ, P. *m. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 1–3) 95–118 (1947) *In erman.*—(1) Arc discharges in Ne, A, Kr and Xe at essures up to 37 atmos. and currents up to 30 A appear be of two types, described respectively as electrode-abilized and convection-controlled. The emitted diation consists of line spectra and continua, the latter aving an energy distribution similar to that of a black ody at 5 200°A and being attributed to recombination nd bremsstrahlung processes. Several illustrations of pectra are given. (2) The relations between the emitted tensity of various parts of the spectra and the discharge rrents (10–30 A) and pressures (up to 37 atmos.) are escribed, and a qualitative discussion is given. The in-nsity of the continua $\propto$ (current)^n, and $n = 1\cdot5$–$2\cdot35$ or the various gases. The line radiation intensity was pprox. $\propto$ the current. J. D. C.

37.529 : 537.226 651

Electric breakdown of solid dielectrics. VON HIPPEL, A. *rans. Faraday Soc.,* **42 A,** 78–87; *disc.,* 87–90 (1946).—ecent experimental work permits amplification of the uthor's theory that breakdown arises from electrons ccelerated after overcoming the friction barrier due to ibrations of the material. The probability with which lectrons of various velocities excite vibrations, and the nergy loss suffered by slow electrons unable to cross this arrier, can be derived. The faster electrons, which etermine the crystallographic orientation of the break-down paths, create characteristic interference patterns by their wave field while being accelerated, and the break-down directions mark paths of lowest friction leading through this interference field. H. G. M. S.

537.529 : 539.16.08 : 548.0 652

Behavior of silver chloride crystal counters. HOFSTADTER, R., MILTON, J. C. D., AND RIDGWAY, S. L. *Phys. Rev.,* **72,** 977–8 (*Nov.* 15, 1947).—From the rise time of the pulse for a given field across the crystal, and from the max. height of the pulses, the mobility of the electron in the crystal and the energy necessary to produce an ion pair are calculated. These calculations assume that the electrons move across the crystal and are not caught in electron traps, which would be present were there any strain in the crystal, as was observed in several cases. W. E. D.

537.531 : 53.081.4 : 548.73 653

X-ray wave-length standards. WOOD, E. A. *Phys. Rev.,* **72,** 436–7 (*Sept.* 1, 1947).—[See Abstr. 635 (1947)].

537.531 : 535.338.334 654

Natural widths and relative intensities of some X-ray spectral lines. BRIL, A. *Physica, 's Grav.,* **13,** 481–9 (*Sept.*, 1947).—The natural widths of the X-ray spectral lines $L\beta_1$, $L\beta_2$, $L\beta_3$ and $L\beta_4$ have been measured for the elements Gd(64), Er(68), W(74) and Th(90). Moreover the measurements of the intensities of $L\beta_3$, $L\beta_4$ and $L\beta_2$ relative to that of $L\beta_1$ have been completed. The widths of $L\beta_3$ and $L\beta_4$ show a variation with atomic number, differing from the variation of the intensities. It is pointed out why no correspondence is to be expected. A.

537.531 : 535.34 : 539.15 655

Atomic absorption coefficient for X-rays. VICTOREEN, J. A. *Phys. Rev.,* **72,** 869 (*Nov.* 1, 1947).—This coefficient, τ_a, is found to be represented by the formula

$$\tau_a = \left\{ \frac{\nu_1\nu_2}{\nu^3} - \frac{\nu_1\nu_2\nu_3}{\nu^4} \right\} K$$

(ν = frequency of incident radiation; ν_1, ν_2, and ν_3 = critical frequencies resulting from rational quantized transitions in the particular atom; K = constant). W. E. D.

537.531 : 535.42 : 539.215.2 656

The shape of X-ray diffraction lines from colloidal magnesium oxide. BERRY, C. R. *Phys. Rev.,* **72,** 942–7 (*Nov.* 15, 1947).—The broadened diffraction lines from colloidal particles have shapes which depend on the particle size and shape and on the geometrical features of the experiment. An analytical method is developed for eliminating the effect of the geometry of the experiment, thereby giving the shape of the diffraction line. The method is applied to the 200, 220 and 222 lines from colloidal MgO. The shapes of these diffraction functions in the low intensity regions are not sufficiently accurate to permit the determination of particle shape. The relative ½-intensity breadths of curves give best agreement with the values to be expected for cube-shaped particles. The particle size, determined from the Scherrer equation, is 140 Å, and the average deviation from this value is 3·1%. A.

537.531 : 535.43 : 615.849 657

Errata: The intensities of direct and scattered X-radiation in a horizontal water sheet exposed to a cylindriform beam of soft vertical X-rays. DE WAARD, R. H. *Proc. K. Ned. Akad. Wet.,* **50** (*No.* 10) 1382 (1947).—[See Abstr. 2573 (1947)].

537.531 : 539.163.2 *see Abstr.* 725

537.531 : 621.317.39 658

Applications of electronic methods to the measurement of X-ray and gamma ray intensities. FRIEDMAN, H. *Industr.*

Radiogr. Non-Destr. Test., **6**, 9–20 (*Summer*, 1947).—[Abstr. 573 B (1948)].

537.531 : 778.33 ; 771.534 *see Abstr.* 796

537.533.7 : 621.385 = 4 659

The exchange of energy between electrons and electrodes at constant potentials. PRACHE, P. M. *Ann. Télécommun.*, **2**, 148–50 (*April*, 1947) *In French.*—[Abstr. 641 B (1948)].

537.533.72 : 539.165 660

On the double focusing beta-ray spectrometer. ROSENBLUM, E. S. *Phys. Rev.*, **72**, 731 (*Oct.* 15, 1947).

537.533.74 : 539.165 *see Abstr.* 730

537.533.75 : 539.165 = 3 *see Abstr.* 731

537.533.9 : 536.422 661

Specimen changes due to electron bombardment in the electron microscope. BURTON, E. F., SENNETT, R. S., AND ELLIS, S. G. *Nature, Lond.*, **160**, 565–7 (*Oct.* 25, 1947).—Opaque crystals of alkali halides became transparent under bombardment, and a deposit sometimes appeared on the surroundings; it is believed, however, that the temperature did not rise high enough for sublimation. Ionic migration is suggested. Evaporated films of $PbCl_2$ gathered into globules which moved on the supporting film.

537.533.9 : 539.18 : 537.56 : 537.591.8 *see Abstr.* 676

537.533.92 : 537.56 : 537.591 *see Abstr.* 667

537.534 : 537.133 662

Electrostatic analyzer for 1·5-Mev protons. FOWLER, W. A., LAURITSEN, C. C., AND LAURITSEN, T. *Rev. Sci. Instrum.*, **18**, 818–20 (*Nov.*, 1947).—A system for analysing the ion beam of an electrostatic generator is described. A weak magnetic field separates protons from heavier components and a 90° electrostatic deflection gives the required energy resolution. With the analyser controlling the generator voltage, a proton beam of 1 μA with an energy spread of $\sim$ 300 V in 10^6 is obtained. A.

537.534 : 538.691 : 539.155.2 *see Abstr.* 704

537.534 : 539.155.2 = 3 663

Source of error in mass-spectrographic doublet measurements. EWALD, H. *Z. Naturforsch.*, **2a**, 384–8 (*July*, 1947) *In German.*—The diameters of the ionic beams in the positive ray discharge at the spectrograph slit for the various types of ion produced simultaneously may be very different. This may lead to systematic errors if the slit is not accurately perpendicular to the direction of the electric field. Discrepancies in the results of various authors for the doublet $^{12}CH_4$–^{16}O may thus be explained. A. J. M.

537.534 : 621.384.6 664

Theory of the synchro-cyclotron. BOHM, D., AND FOLDY, L. L. *Phys. Rev.*, **72**, 649–61 (*Oct.* 15, 1947).—[Abstr. 639 B (1948)].

537.534 : 621.384.6 665

The "Gigator"—a proposed new circular accelerator for heavy particles. WIDERÖE, R. *Phys. Rev.*, **72**, 978 (*Nov.* 15, 1947).—[Abstr. 640 B (1948)].

537.534.74 : 539.152.1 *see Abstr.* 692–3

537.56 : 537.533.92 : 537.591 *see Abstr.* 667

537.56 : 539.18 : 537.533.9 : 538.591.8 *see Abstr.* 676

537.56.08 = 3 666

Measurement of very small ionization using the gas-flow ion chamber (after G. Hoffmann). HERFORTH, L. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 4–5) 251–60 (1947) *In German.*—Gas in which primary ionization occurred was swept into a low pressure region where gas multiplication of the electrons was produced. (To avoid electron capture, carefully purified N_2 was used.) The resulti current to the collecting electrode was amplified a measured. The ratio of specific ionizations of α- a β-particles was found to be $\sim$100 : 1. A. P.

537.562 : 539.16.08 *see Abstr.* 712

537.569.4 : 535.33.072–14 *see Abstr.* 570

537.583 : 535.231.4 : 536.33 = 4 *see Abstr.* 599

COSMIC RAYS 537.591

537.591 : 537.533.92 : 537.56 6

The specific primary ionization of 1-Mev electro relative to sea level cosmic radiation. HEREFORD, F. *Phys. Rev.*, **72**, 982–3 (*Nov.* 15, 1947).—The avera specific primary ionization of cosmic rays at sea lev was compared with that of 1 MeV electrons, and w found to agree with Bethe's theory of energy loss collision in contrast with the results of Cosyns. W. E.

537.591 : 539.16 : 535.11 *see Abstr.* 566

537.591 : 550.423 : 539.155.2 : 539.167.3 *see Abstr.* 736

537.591.1 : 539.18 6

Positive excess of slow mesotrons at an altitude 3·5 km. CORRELL, M. *Phys. Rev.*, **72**, 1054–60 (*Dec.* 1947).—Cloud-chamber tracks of mesotrons havir momenta between $1{\cdot}25\times10^8$ and $2{\cdot}5\times10^8$ eV/c we photographed at an altitude of 3·5 km. Mesotrons this momentum range were selected by a special designed anticoincidence circuit. The tracks were curve by a magnetic field of 1 670 gauss. A 1·25-cm Pb pla above, and two 1-cm Pb plates within the chamb enabled one to distinguish electrons from mesotrons b multiplication phenomena. Mesotrons of these momen easily penetrate several centimetres of Pb, while proto of equal momenta have a range in Pb of $<0{\cdot}2$ mn Examination of 320 mesotron tracks which traversed bot Pb plates in the chamber and had momenta in the selecte range showed that 47·2% of the mesotrons carried positiv charges while the remaining 52·8% were negativ Hence, within the $\pm$ 5·6% precision of this experimen positive and negative mesotrons having energies betwee $0{\cdot}6\times10^8$ and $1{\cdot}7\times10^8$ eV occur in equal numbers at a elevation of 3·5 km.

537.591.15 6

Extensive air showers and the cascade theory. COCCON G. *Phys. Rev.*, **72**, 964–6 (*Nov.* 15, 1947).—The barc metric effect, the density spectra at different barometri pressures and the variation of frequencies with heigh above sea level have been calculated for extensive a showers, on the basis of the cascade theory. Goo agreement has been found between theoretical results an experimental data.

537.591.15 = 4 67

Discussion of recent experiments on extensive a showers (Auger showers). DAUDIN, J., AND LOVERDO, A *J. Phys. Radium* (*Sér.* 8) **8**, 233–7 (*Aug.*, 1947) *In French.*— Recent studies of particle density in air showers are dis cussed with particular reference to the statistical trea ment of counter data due to Cocconi [Abstr. 290 (1946)]. J. G. W

537.591.5 67

The latitude effect of the hard component as a functio of altitude. GILL, P. S., SCHEIN, M., AND YNGVE, *Phys. Rev.*, **72**, 733 (*Oct.* 15, 1947).—Experiments up t heights of 40 000 ft indicate that a considerable numbe of mesons produced by non-ionizing rays can penetrat 8 cm of Pb but are absorbed completely by 22 cm of Pb Curves, giving the variation in intensity of the pene

ng component with height at geomagnetic latitude N and at the equator, show that the latitude effect these rays increases considerably with height. W. E. D.

591.5 : 539.18 672

emperature effect of cosmic radiation at 1 000-m water ivalent depth. FORRÓ, M. *Phys. Rev.*, **72**, 868–9 v. 1, 1947).—The effect of the atmospheric temp. on intensity of cosmic rays at a depth of 1 000 m of water found to be $+0{\cdot}74 \pm 0{\cdot}13\%$/deg. C; there is no ct due to variation in barometric pressure. The temp. ct has the appropriate sign for this penetrating radia- to consist of neutrinos produced by meson disintegra- in the atmosphere, but the magnitude of the effect is large, by a factor of ~ 5, to be consistent with this othesis. W. E. D.

.591.8 673

he production of secondary electrons by collision of ons in the air and in iron. CLAY, J. *Physica, 's Grav.*, 433–46 (*Sept.*, 1947).—A continuation of previous asurements [Abstr. 1525 (1945)] on the production of h energy electrons by collision of mesons in different terials. It was necessary to know the variation of the ttered electrons according to their distance from the mary mesons. For this purpose 5-fold coincidences re counted during a period of one year; it was found it in the atmosphere the accompanying electrons 2×10^6 eV number in total about 9–18% of the number mesons, so that it is probable that half the soft com- nent in the atmosphere has its origin in the collision the mesons. The production of electrons in a 2-cm te of Fe was examined in 3 different directions, and absorption in each direction measured in layers of 10 cm Pb. The effective cross-section in Fe was $\times10^{-27}$ cm². The total production of electrons 2×10^6 eV under a thick layer of Fe is 9% of the sons penetrating the Fe layer. Under a layer of Pb was not possible hitherto to distinguish between condary electrons and photons. A.

7.591.8 674

On the generation in paraffin of ionizing penetrating rticles by a neutral component of the cosmic radiation. TLONE, C., AND TONGIORGI, V. *Phys. Rev.*, **72**, 735–6 Oct. 15, 1947).—Experiments show that if any pene- ating ionizing particles are produced in paraffin at a level by neutral radiation their abundance is $<1\%$. W. E. D.

7.591.8 = 5 675

On the knock-on electrons produced by mesons. TON- ORGI, V. *Nuovo Cim.*, **3**, 342–8 (*Oct.*, 1946) *In alian.*—The mean angular spread of the electrons nocked on by mesons in Pb, Fe, Al, has been studied by gistering the coincidences between a vertical telescope nd two counters on either side. The influence of the attering of the electrons on the results is discussed. he thickness of Pb in which the secondary electrons are equilibrium with the primary radiation has been found be $\simeq 8$ g/cm². G. P. S. O.

37.591.8 : 537.533.9 : 539.18 : 537.56 676

Ionization of high energy cosmic-ray electrons. HAY- ARD, E. *Phys. Rev.*, **72**, 937–42 (*Nov.* 15, 1947).— he ionization was measured in a cloud chamber to etermine whether the probable ionization produced by a igh velocity particle continues to rise logarithmically with ne energy. A lateral clearing field was arranged so that he ionization could be measured in the upper half of the loud chamber; Pb plates were placed in the lower half o that the electron would produce a shower from which ts energy could be estimated. The ionization produced by electrons was measured and compared to the minimum ionization (medium velocities) as determined from the average ionization produced by mesotrons. According to the theoretical formula of Halpern and Hall, the max. ionization should be $1{\cdot}4\ I_{min}$. In most of the pictures taken the ionization was consistent with this value. There were several pictures, however, where the ionization was extremely high. These may indicate that the theoretical formula is invalid, or they may result from the coincidence of two or more particles. A.

537.591.8 : 539.18 677

On the production of cosmic-ray mesotrons by primary protons. SCHEIN, M., AND STEINBERGER, J. *Phys. Rev.*, **72**, 734–5 (*Oct.* 15, 1947).—On the basis of certain assumptions about the energy distribution of the primary protons and the mechanism for their production of mesons, and by comparison with the experimental results of Gill, Schein and Yngve [Abstr. 671 (1948)] it is deduced that mesons are produced at a height where the pressure is 2 cm of Hg, and that on the average 5 mesons are produced at a proton collision. W. E. D.

MAGNETISM 538

538.222 : 536.48 678

Paramagnetic dispersion in some copper and silver salts. BROER, L. J. F., AND KEMPERMAN, J. *Physica, 's Grav.*, **13**, 465–72 (*Sept.*, 1947).—Measurements were made on $Cu(NH_4)_2$, CuK_2 and Cu pyridine sulphates. The occurrence of dispersion is in agreement with theory, but the specific heats of the spin system in all cases are much too large to be accounted for by magnetic interaction. The difficulty met in comparing the caloric, magnetostatic and relaxation data on $CuSO_4$ is discussed. A.

538.222 : 539.132 679

Magnetic resonance absorption of chromic ammonium alum. WEISS, P. R., WHITMER, C. A., TORREY, H. C., AND HSIANG, J.-S. *Phys. Rev.*, **72**, 975 (*Nov.* 15, 1947).—The maxima in the absorption curve for both powdered material and single crystals, measured in a wave-guide cavity resonator under different steady magnetic fields, can be explained by assuming a splitting of $0{\cdot}15 \pm 0{\cdot}01$ cm^{-1} in the lowest energy state produced by an axially symmetrical electric field due to the water molecules in the molecule. W. E. D.

538.242 : 537.312.62 680

Note on the gyromagnetism of superconductors and diamagnetic media. BROER, L. J. F. *Physica, 's Grav.*, **13**, 473–8 (*Sept.*, 1947).—It is shown that the existence both of the penetration depth and the gyromagnetic effect in superconductors can be deduced from the conservation of angular momentum. The latter effect therefore can give no new information on the nature of the superconductive state. The implications of the conservation law for diamagnetic bodies are discussed briefly. A.

538.245 681

Interpretation of high coercivity in ferromagnetic materials. STONER, E. C., AND WOHLFARTH, E. P. *Nature, Lond.*, **160**, 650–1 (*Nov.* 8, 1947).—A theory similar to that of Néel [Abstr. 2935, 3259–60 (1947)] has been independently developed and detailed calculations made of the effect of shape anisotropy of particles of $<$ min. domain size. Some preliminary results are quoted, applicable to (*a*) metals and alloys containing ferromagnetic "impurities," (*b*) high coercivity alloys of the dispersion-hardening type.

ELECTROMAGNETISM . ELECTRODYNAMICS 538.3/.5

538.3 : 530.145 *see Abstr.* 526

538.56 : 535.42 : 621.392 682

The double current sheet in diffraction. SMYTHE, W. R. *Phys. Rev.*, **72**, 1066–9 (*Dec.* 1, 1947).—The electromagnetic radiation from an aperture in a plane-conducting screen is identical with that which would exist if screen and aperture were replaced by a double current sheet fitting the aperture. The current density i is equal and opposite in the two layers of the sheet and is determined by the original tangential electric field E over the opening so that E is $-\frac{1}{2}j\omega\mu\delta i$. The distance δ between layers is infinitesimal. A rigorous expression for the vector potential of the emergent radiation in terms of E is given. This is the expression used by Bethe [Abstr. 524 B (1945)]. It is shown to provide a simpler method of getting the results of Stratton and Chu for rectangular openings [Abstr. 3467 (1939)]. It is then applied to the calculation of the excitation of a rectangular waveguide by a coaxial line termination in one side. An expression for the output resistance is given. A.

538.561 : 537.525.8 = 4 *see Abstr.* 648

538.566.2 = 4 683

The propagation of electromagnetic waves in two or more successive media and the diffraction of these waves treated as Cauchy problems. ROBIN, L. *Rev. Sci., Paris*, **84**, 7–14 (*Jan.–May*, 1946) *In French.*—The propagation and diffraction of the waves is treated mathematically by a method involving an integro-differential equation. The process for solving this is described and some examples are given. L. S. G.

538.569.3 : 532.133 : 537.226.1 *see Abstr.* 631

538.569.3 : 537.226 *see Abstr.* 619

538.569:3 : 537.226.1 *see Abstr.* 627–30

538.569.3 : 541.133 684

The radio-frequency absorption spectra of solutions of electrolytes. FORMAN, J., AND CRISP, D. J. *Trans. Faraday Soc.*, **42 A**, 186–93; *disc.*, 193–4 (1946).—An account of tests carried out over the frequency range 25–375 Mc/s on monovalent, divalent and trivalent chlorides in aqueous solutions of various concentrations, to explore ionic polarization and to determine relaxation times. Two methods were employed to determine max. absorption: (*a*) the measurement of temperature rise using a quartz calorimeter in the field of the oscillator capacitor; and (*b*) the resonance method using a linear coaxial line or lumped circuits. The derived values of relaxation times were at least of the same order of magnitude as those produced by Falkenhagen and several factors are suggested to account for the discrepancies which appeared. Curves broadened with increasing valency and anomalous effects with HCl at concentrations above 1 mole. H. G. M. S.

MAGNETIC EFFECTS 538.6

538.615 : 535.343.4–14 *see Abstr.* 579

538.691 : 537.534 : 539.155.2 *see Abstr.* 704

ATOMIC AND MOLECULAR STRUCTURE 539

539.11 : 536.631 685

Averages over normal modes of coupled oscillators with application to theory of specific heats. MONTROLL, E. W. *Quart. Appl. Math.*, **5**, 223–7 (*July*, 1947).—The method of averaging is described and a numerical example is given. In this the specific heat of tungsten is determined. L. S. G.

539.11 : 541.123 : 532.782 68

On simple binary solid solutions. LAWSON, A. W. *J. Chem. Phys.*, **15**, 831–42 (*Nov.*, 1947).—The effect of difference in atomic volume between two components of a simple binary solid solution on the phase equilibrium curves is investigated by calculating the energy of deformation required to replace a smaller atom by a larger atom and vice versa. The strain energy is introduced to the free-energy function derived by the quasi-chemical technique of Guggenheim [Abstr. 114 (1939)] and leads to expressions similar to those of Hildebrand [Abstr. 1688 (1929)] for unsymmetrical segregation. In addition the Mie–Grüneisen equation is used to estimate the effect of vibrational entropy changes, which has a smaller effect on phase equilibria in general than the energy changes. Finally, the results are used to justify certain empirical thermodynamic expressions. A.

539.11 · 548.7 *see Abstr.* 776

539.13 : 535.338.4 : 536.654 68

On the dissociation energy of carbon monoxide and the heat of sublimation of carbon. HAGSTRUM, H. D. *Phys. Rev.*, **72**, 947–63 (*Nov.* 15, 1947).—None of the values of the dissociation energy of carbon monoxide, $D(CO)$ proposed on the basis of interpretations of predissociations in the spectrum of CO is in satisfactory agreement with the results of electron-impact experiments. The only possible interpretation of these experiments gives $D(CO) = 9{\cdot}6$ eV. Compelling reasons can be given for considering this result of sufficient accuracy to make it irreconcilable with any of the values from the band spectrum. A new interpretation of the effects in the spectrum which brings agreement with the electron impact value is possible, however. It involves a potential curve with maximum for $J = 0$ for the state $a'^3\Sigma^+$ of CO which predissociates $B^1\Sigma^+$ and $b^3\Sigma^+$ at 11·11 eV. Various data favour this interpretation and its consequences. Satisfactory agreement among all data bearing on $D(CO)$ and $L_1(C)$, the heat of sublimation of carbon, can be attained in this way. A.

539.13 : 535.5 : 535.343.2–15 *see Abstr.* 575

539.132 68

The asymmetric rotor. VI. Calculation of higher energy levels by means of the correspondence principle. KING, G. W. *J. Chem. Phys.*, **15**, 820–30 (*Nov.*, 1947).—The rotational levels of the rigid asymmetric rotor can be calculated by means of the correspondence principle. It is shown that the quantum-number ratio $K/J(J+1)$ is the complete elliptic integral of the third kind tabulated by Heuman in the case of the energy levels of a hypothetical rotor with reciprocal moments of inertia -1, κ, and $+1$. The parameter of the integral is the reduced-energy ratio $E(\kappa)/J(J+1)$, and its modulus is a function of both the reduced-energy ratio and asymmetry parameter. A double inverse interpolation has been made by Heuman's table to give the energy ratio directly in terms of quantum-number ratio and asymmetry. Power series expansions have been developed around limiting cases and around each point in the table, so that formulae for interpolation and estimating errors are available. A.

539.132 : 535.343.4–14 *see Abstr.* 580

539.132 : 535.343.4–15 *see Abstr.* 583

539.132 : 538.222 *see Abstr.* 679

539.133 689

Restricted bond rotation and shape of unbranched saturated hydrocarbon chain molecules. KUHN, H. *J. Chem. Phys.*, **15**, 843–4 (*Nov.*, 1947).—Calculations of the effect of restricted bond rotation and steric hindrance of accidentally coinciding parts of the chain lead to values

the mean square length in close agreement with se determined from viscosity and flow birefringence asurements.

.133 : 535.343.4–14 *see Abstr.* 581–2

.133 : 535.343.4–15 690

On the structure of ozone. SIMPSON, D. M. *J. Chem. s.*, **15**, 846 (*Nov.*, 1947).—It is pointed out that Adel l Dennison's experimental data on the infra-red bands ostr. 2928 (1946)] are not incompatible with a wide- led structure for the molecule [Abstr. 660 (1947)].

.15 : 535.34 : 537.531 *see Abstr.* 655

.152.1 : 530.14 = 4 *see Abstr.* 518

.152.1 : 537.122 691

Does the electron have an intrinsic magnetic moment? arr, G. *Phys. Rev.*, **72**, 984 (*Nov.* 15, 1947).—If the ctron has an intrinsic magnetic moment, μ_e, and the clear magnetic moment is denoted by μ_N and the Bohr gneton by μ_0, molecular beam experiments give a asure of $\mu_N/(\mu_0 - \mu_e)$ whereas atomic beam experi- nts [Abstr. 2614 (1947)] give $\mu_N(\mu_0 + \frac{1}{2}\mu_e)$. In order account for the discrepancy between the measurements the hyperfine structure of H and D and the respective ues calculated from their nuclear magnetic moments s necessary to make $\mu_e/\mu_0 = -0{\cdot}0056$. The implica- ns of this are discussed in a number of cases. W. E. D.

.152.1 : 537.534.74 692

On the proton-proton scattering at 14·5 Mev. LOPES, ., AND TIOMNO, J. *Phys. Rev.*, **72**, 731 (*Oct.* 15, 1947). These experiments indicate that probably a non- gular tensor force acts between protons in the triplet tate. W. E. D.

.152.1 : 537.534.74 693

Proton-proton scattering at 10 Mev. FOLDY, L. L. *ys. Rev.*, **72**, 731–2 (*Oct.* 15, 1947).—Criticisms are ade of the computations of Peierls and Preston [Abstr. 82 (1947)]. It is also pointed out that the accuracy of periments on proton-proton scattering is not sufficient permit of an unambiguous deduction of the mutual tential of nucleons. W. E. D.

.152.1 : 539.153 *see Abstr.* 701

.152.1 : 539.164 694

On the role of exchange forces in the nuclear 3- and body problems. SVARTHOLM, N. *Ark. Mat. Astr. Fys.*, A (*Paper* 7) 7 *pp.* (1947).—The use of exchange forces stead of ordinary forces makes little difference to the nding energies of H^3 and He^4. A more complete lculation than that given previously [Abstr. 1349 46), 695 (1948)] shows that the difference is even naller than was then estimated. G. J. K.

.152.1 : 539.164 695

Calculation of the ground state of the alpha-particle. ARTHOLM, N. *Ark. Mat. Astr. Fys.*, **35 A** (*Paper* 8) *pp.* (1947).—The iterative method previously developed bstr. 1349 (1946)] is now used to the next higher proximation, also allowing more completely for spin change forces. The energy of the α-particle still mains too small for interaction constants derived from attering experiments. G. J. K.

.152.1 : 539.172.4 *see Abstr.* 748

.152.1 : 539.181 696

The radiofrequency spectra of the sodium halides. ERENBERG, W. A., AND RAMSEY, N. F. *Phys. Rev.*, **72**, 75–89 (*Dec.* 1, 1947).—The radiofrequency spectra of $Na^{23}Br$, $Na^{23}Cl$, and $Na^{23}I$ have been investigated by e of the molecular-beam resonance method. In ternal fields of approximately 10 000 gauss, the spectra e about 1 Mc/s wide, continuous, and of a charac- teristic form with a deep central minimum and two smaller side minima. The central minimum agrees in frequency to 0·2% with the Larmor frequency for a decoupled Na^{23} nucleus. In the statistical theory of Feld and Lamb [Abstr. 1922 (1945)] the continuous nature of the spectrum is a result of the large number, $2J + 1$, of magnetic states of the molecule for large rotational quantum numbers, J. The triple minima are characteristic of nuclear spin $\frac{3}{2}$. The spectra were further studied in progressively lower fields. In the limit of zero field (resonance minima of a type not heretofore observed) a single resonance is observed for each compound at a frequency equal to the difference between the side minima observed in strong fields for the same compound. This is in good agreement with the predictions of Feld and Lamb. These frequencies are 1·22, 1·42, and 0·99 Mc/s for NaBr, NaCl, and NaI, respectively. The analysis of the spectra indicates the possibility of an additional interaction of the form $c\mathbf{I}\cdot\mathbf{J}$, whose average value is 0·05 Mc/s. A.

539.152.1 : 621.396.621.5 697

Two new methods for detecting nuclear radiofrequency resonance absorption. ROBERTS, A. *Rev. Sci. Instrum.*, **18**, 845–8 (*Nov.*, 1947).—Nuclear r.f. absorption can be observed by means of a super-regenerative detector. The sample is placed in the coil of the resonant circuit, and reacts to produce an observable signal by nuclear absorption when the external magnetic field is such as to produce a Larmor precession at the same frequency as that of the super-regenerative detector. An autodyne detector, oscillating weakly, can also be used to observe nuclear resonance absorption. A.

539.152.2 : 537.133 698

The magnetic moment of the deuteron. ROBERTS, A. *Phys. Rev.*, **72**, 979 (*Nov.* 15, 1947).—Improvements on previous work [Abstr. 944, 2616 (1947)] are made and a value of $\mu_H/\mu_D = 3{\cdot}25731 \pm 0{\cdot}00015$ is obtained. W. E. D.

539.153 : 535.338.3–32 699

A suggested experiment to detect the shift of $1^2S_{\frac{1}{2}}$ level of H and He^+. WU, T.-Y. *Phys. Rev.*, **72**, 976–7 (*Nov.* 15, 1947).—To make the comparison between H and He^+, it is suggested that the Lyman α of H at $\sim 1\,200$ Å and the Lyman α of He at ~ 300 Å be observed on the same plate in the 1st and 4th orders respectively. W. E. D.

539.153 : 535.338.332 700

Newly observed structure in He II λ4686. MACK, J. E., AND AUSTERN, N. *Phys. Rev.*, **72**, 972 (*Nov.* 15, 1947).—The splitting of the $(3_{\frac{1}{2}}$–$4_{\frac{1}{2}})$ component of the λ4686 line complex of ionized He has been measured and a separation of about $0{\cdot}16 \pm 0{\cdot}02$ cm^{-1} found; this is in reasonable agreement with the results of Bethe's calculations [Abstr. 3608 (1947)]. W. E. D.

539.153 : 539.152.1 701

Effect of nuclear motion of the hyperfine structure of the ground term of hydrogen. BREIT, G., AND MEYEROTT, R. E. *Phys. Rev.*, **72**, 1023–37 (*Dec.* 1, 1947).—It is found that the correction factor can be represented by $(1 + m/M)^{-3}$ to within terms of order $(m/M)\alpha^2 \log \alpha$, where m, M are, respectively, the masses of the electron and nucleus while α is the fine structure constant. It is assumed that the Coulomb potential is that of a point charge for distances $> r_0 = e^2/mc^2$ and that for distances $< r_0$ it is $\sim mc^2$. This assumption makes it possible to treat the problem by means of existing theories. First-order perturbation theory for the effect of the nuclear magnetic field is employed. The calculations for the part of the proton's magnetic moment following from

Dirac's equation are described first, and then the effect of the part of the magnetic moment of the proton which is not accounted for by Dirac's equation, and is referred to as the Pauli part. The deuteron is also discussed. A.

539.153 : 539.181 702

The hyperfine structure of atomic hydrogen and deuterium. NAGLE, D. E., JULIAN, R. S., AND ZACHARIAS, J. R. *Phys. Rev.*, **72**, 971 (*Nov.* 15, 1947).—Results obtained by atomic beam magnetic-resonance experiments are similar to those of Nafe, Nelson and Rabi [Abstr. 2614 (1947)] giving $(\Delta\nu)_H = 1\,420{\cdot}47 \pm 0{\cdot}05$ Mc/s and $(\Delta\nu)_D = 327{\cdot}380 \pm 0{\cdot}003$ Mc/s in disagreement with the Fermi formula. Their ratio agrees with theory within the limits of experimental error. W. E. D.

539.154.2 : 539.163 = 3 *see Abstr.* 717

539.155.2 : 521.042 = 3 703

On the abundance of nuclei in the universe. I. Some abundance rules and their application to the estimation of the amounts of medium-heavy and heavy nuclei. SUESS, E. *Z. Naturforsch.*, **2a**, 311–21 (*June*, 1947) *In German.*—The available data on the abundance of nuclei and their isotopes is analysed with the aid of simple rules consistent with known properties of isobars and isotopes. G. J. K.

539.155.2 : 523.11 *see Abstr.* 496

539.155.2 : 537.534 = 3 *see Abstr.* 663

539.155.2 : 537.534 : 538.691 704

On the separation of isotopes in quantity by electromagnetic means. SMITH, L. P., PARKINS, W. E., AND FORRESTER, A. T. *Phys. Rev.*, **72**, 989–1002 (*Dec.* 1, 1947).—The limitations imposed by space charges on the separation of ions in the usual magnetic mass spectrograph and the possibility of trapping electrons in the ion beam are described. It is found that high voltages and intense magnetic fields are required for moderate ion currents unless the space charges are neutralized. Calculations are given on velocity-modulated or interrupted ion beams, and the performance of a modulated separator is described. The theory of a radial magnetic separator is given in some detail; an experimental arrangement of such a separator proved more successful than the separator employing modulation. Some ion sources and suggested improvements are described. A.

539.155.2 : 539.163 705

The isotopic constitution of lanthanum and cerium. INGHRAM, M. G., HAYDEN, R. J., AND HESS, D. C., JR. *Phys. Rev.*, **72**, 967–70 (*Nov.* 15, 1947).—The isotopic abundances have been determined by means of a mass spectrometer. In addition to the known La isotope of mass 139, a new isotope of mass 138 and abundance 0·089% has been discovered. Since this isotope is isobaric with two neighbouring stable isotopes it should be radioactive. No activity was observed. Upper limits for the non-existence of other La isotopes were determined. The abundances of Ce isotopes of masses 136, 138, 140 and 142 were shown to be 0·193, 0·250, 88·48 and 11·07%, respectively. Upper limits for the non-existence of other Ce isotopes were determined. A.

539.155.2 : 541.133.1 706

Calculations on countercurrent electromigration. BREIT, G., AND FRIEDMAN, F. L. *J. Res. Nat. Bur. Stand., Wash.*, **39**, 397–409 (*Nov.*, 1947).—The mathematical problems presented by the countercurrent electrolysis method for isotope separation are treated under simplified assumptions. The solutions are worked out for a tube of finite length. The formulae are put into numerical form and simpler formulae are obtained, in the approximation of tubes of ∞ length; some of the results are presented in the form of graphs. The orders of magnitude of effects to be expected are discussed.

539.155.2 : 550.423 : 537.591 : 539.167.3 *see Abstr.* 736

539.155.2 : 621.318.572 7

Scale expander for mass-spectrometer recorder. GRO D. J., AND HIPPLE, J. A. *Rev. Sci. Instrum.*, **18**, 837–(*Nov.*, 1947).—A device similar to Abstr. 393 (1948) described; passage through a peak recorded on a logari mic scale [Abstr. 2235 (1945)] automatically opera relays for the selection of an appropriate linear scale f the recording of the peak top. Thus wide range (2 3 000 mV) is recorded on a single record without loss accuracy.

539.155.2.08 : 578 7

A mass spectrometer for isotope analysis. LINDHOLM, *Ark. Mat. Astr. Fys.*, **34 B** (*Paper* 25) 7 *pp.* (1947).—T design of a semi-circular focusing mass-spectrome primarily intended for biological work, is given. T spectrometer is constructed with a glass envelope and Cu electrode system. Stabilizing circuits for emission a high voltage supply are given. Some preliminary resu are appended. J. H.

RADIOACTIVITY . NUCLEAR DISINTEGRATIO NUCLEAR PARTICLES 539.16/.18

539.16 : 537.591 : 535.11 *see Abstr.* 566

539.16.08 7

"Emanating power" of actiniferous compounds of L PEREY, M. *J. Phys. Radium* (*Sér.* 8) **8**, 179–82 (*Jun* 1947) *In French.*—The emanating power, defined as t ratio of the An which escapes to the total An produce was studied for a number of La compounds as a functio of temp., chemical composition, surface area and A concentration. A. P.

539.16.08 7

Escape of thoron from thorium X salts. BĚHOUNEK, F AND KLUMPAR, J. *Nature, Lond.*, **160**, 640–1 (*Nov.* 1947).—It was found that only radon escaped from leak containers of Ra and Th salts, unless there was a sub stantial pressure difference, in which case thoron als escaped.

539.16.08 71

The absolute strength of radioactive sources. WIEDE BECK, M. L. *Phys. Rev.*, **72**, 974 (*Nov.* 15, 1947).—Th number of disintegrations per sec, N, of a β-active sour is shown to be $N = N_\beta N_\gamma / N_{\beta\gamma}$, where N_β and N_γ are t number per sec of β- and γ-counts and $N_{\beta\gamma}$ the numbe per sec of β-γ coincidences. This method is independe of counter efficiency and geometry and gives an accurat method for measuring ½-lives of long life activities. small correction for β-counter window absorption needed if the β-spectrum is complex. W. E. I

539.16.08 : 537.562 71

Ionization currents from extended alpha-sources. BLA M., AND CARLIN, J. *Rev. Sci. Instrum.*, **18**, 715–2 (*Oct.*, 1947).—The ionization currents produced i chambers (some 20 cm effective plate dia.) due t Po-covered brass or Ni discs (~ 2·54 cm dia.) wer measured as functions of Po density. For constan activity/cm², the effect of varying source area, up t 80 cm², was also investigated. Results are show graphically, some discussion of the apparent recombina tion coefficients obtaining in the ionization chamber given, and the application of the results to the direc measurement of areas is described. J. D. C

16.08 : 548.0 : 537.529 *see Abstr.* 652

16.08 : 621.318.572 713

ie model 200 pulse counter. HIGINBOTHAM, W. A., LAGHER, J., AND SANDS, M. *Rev. Sci. Instrum.*, **18**, 15 (*Oct.*, 1947).—[Abstr. 606 B (1948)].

16.08 : 621.318.572 714

new scale-of-ten recorder. LOWDE, R. L. *J. Sci. um.*, **24**, 322–4 (*Dec.*, 1947).—[Abstr. 607 B (1948)].

16.08 : 621.396.615.17 715

calibrating multivibrator for use in radio-isotope ies. MAURO, A., AND BARRY, M. C. *Rev. Sci. um.*, **18**, 856 (*Nov.*, 1947).—[Abstr. 744 B (1948)].

16.08 : 778.3 = 5 716

erification of a new formula for the grain spacing along racks of ionizing particles in photographic emulsions. ERA, G. *Nuovo Cim.*, **3**, 320–7 (*Oct.*, 1946) *In an.*—By a modification of Wilkins' and Helens' ry the variation of the spacing of developed grains g the track of an ionizing particle of known mass energy is calculated. The results are verified erimentally. G. P. S. O.

163 : 539.154.2 = 3 717

n the isolation of new naturally occurring elements. AE, B., AND KORSCHING, H. *Z. Naturforsch.*, **2a**, (*Aug.*, 1947) *In German.*—The observation of 3 new rticle groups (1·2, 1·9 and 2·2 cm) is reported. mical tests seem to show that three different radio- ents are involved, none of which has the known mical properties of any element up to U. A. P. F.

163 : 539.155.2 *see Abstr.* 705

.163.1 718

alf-life of tritium. NOVICK, A. *Phys. Rev.*, **72**, 972 *v.* 15, 1947).—The ½-life was found to be 12·1 ± yr by measuring the quantity of He^3 produced in a en time from samples of known tritium content. W. E. D.

.163.1 719

he half-life of tritium. GOLDBLATT, M., ROBINSON, S., AND SPENCE, R. W. *Phys. Rev.*, **72**, 973 (*Nov.* 15, 7).—Preliminary measurements on the ionization duced in an ionization chamber containing hydrogen tritium give a ½-life of 10·7 ± 2·0 yr. W. E. D.

163.1/.2 : 539.185 *see Abstr.* 757

.163.2 720

An attempt to determine the range of ^{235}U[α-rays] from radiation of a normal uranium sample. VAN DER AS, G. J., AND YNTEMA, J. L. *Physica, 's Grav.*, **13**, 3–8 (*Sept.*, 1947).—With the aid of a linear amplifier α-radiation of U^{235} was detected in the radiation of ample of U oxide. Four sets of number-deflection tistics of the oscillograph deflections were deter- ed, each of which shows a clear surplus due to the adiation of U^{235}. From the position of the surplus it n be concluded that the range of U^{235} is between that U^{234} and U^{238}, but nearer to that of the latter. A.

.163.2 721

Gamma-rays from Cu^{64}, annihilation of swift positrons, l experiments on orbital-electron capture. DEUTSCH, M. *ys. Rev.*, **72**, 729–30 (*Oct.* 15, 1947).—Cu^{64} is found to it one nuclear 1·35 MeV γ-ray for every 40 ± 5 sitrons, apart from annihilation radiation. W. E. D.

.163.2 722

β- and γ-radiation from U^{239} and Np^{239}. SLÄTIS, H. *ture, Lond.*, **160**, 579–80 (*Oct.* 25, 1947).—The β-spectra d internal conversion spectra were studied in a mag- tic lens spectrograph. U^{239} gives a 73-keV γ-ray, and s a double β-ray spectrum (E_{max} 1·12, 2·06 MeV), indicating partial β-decay to an excited Np nucleus, with cascade emission of the 73-keV and an 870-keV γ-ray. For Np^{239}, three new γ-rays (57, 61, 67 keV) were found, in addition to the three (206, 227, 275 keV) found by Phillip, Riedhammer and Wiedemann [*Naturwiss.*, **32**, 230 (1944)]. The β-spectrum is fourfold; a level scheme for the decay is given.

539.163.2 723

Disintegration scheme of 1·7-year Cs^{134}. ELLIOTT, L. G., AND BELL, R. E. *Phys. Rev.*, **72**, 979–80 (*Nov.* 15, 1947).—Two soft β-rays of energies 0·035 and 0·250 MeV were observed and three γ-rays of energies 0·568 ± 0·015, 0·602 ± 0·015, and 0·794 ± 0·015 MeV, with relative intensities of 0·26, 1·0 and 1·0. A level diagram is proposed. W. E. D.

539.163.2 724

Decay scheme of $_{45}Rh^{106}$. PEACOCK, W. C. *Phys. Rev.*, **72**, 1049–53 (*Dec.* 1, 1947).—The decay scheme of 30-sec Rh^{106} is proposed as a complex β-spectra with end points at 3·55 ± 0·10 and 2·30 ± 0·10 MeV. The latter is 18 ± 2% abundant and is followed by two γ-rays 0·51 ± 0·02 and 0·73 ± 0·02 MeV in cascade, or a single 1·25 ± 0·05-MeV γ-ray. The 1·25-MeV γ is present in 1–2% of the disintegrations. Evidence in support of the Gamow–Teller selection rules for β-decay is given. A.

539.163.2 : 537.531 725

X-ray emitting isotopes of radioactive Sb and Sn. COLEMAN, K. D., AND POOL, M. L. *Phys. Rev.*, **72**, 1070–4 (*Dec.* 1, 1947).—Three new X-ray-emitting activities in Sb with ½-lives of 2·8, 5·1 and 39 hr have been found by the use of the curved crystal camera in conjunction with the X-ray decay curves. The assignments are Sb^{117}, Sb^{118} and Sb^{119} respectively. All three decay by *K*-electron capture giving characteristic Sn X-rays. The 2·8-hr Sb^{117} also emits 0·46-MeV electrons while the 5·1-hour Sb^{118} gives 0·20-MeV electrons and 1·5-MeV γ-rays. X-ray periods of 1·25 days and 9 days have been found in Sn. The reported decay scheme for Sn^{113} [Abstr. 3977 (1939)] was verified, but the 0·085-MeV γ-ray was not found. A.

539.163.2 : 539.165 726

Energy of beta-radiation from S^{35} and C^{14}. SOLOMON, A. K., GOULD, R. G., AND ANFINSEN, C. B. *Phys. Rev.*, **72**, 1097–1100 (*Dec.* 1, 1947).—Aluminium-absorption curves have been obtained for C^{14} and S^{35}. The ranges in Al measured by Feather's method [Abstr. 4894 (1938)], are 27·9 ± 0·3 mg/cm² for C^{14} and 31·4 ± 0·5 mg/cm² for S^{35}. The energies deduced from these ranges are 154 ± 4 keV for C^{14} and 167 ± 4 keV for S^{35}. Measurements have also been made of the self-absorption of $BaC^{14}O_3$, yielding an absorption coefficient α = 0·29. A.

539.163.2 : 539.166 727

Angular correlation of successive gamma-ray quanta. BRADY, E. L., AND DEUTSCH, M. *Phys. Rev.*, **72**, 870–1 (*Nov.* 1, 1947).—A definite anisotropy was found for pairs of γ-rays from Sc^{46}, Co^{60} and Y^{86} but not for those from Cs^{134}. W. E. D.

539.163.2 : 539.172.4 = 3 728

The radiations of long period emitted after transmutation of Ta by neutrons. NEUERT, H. *Z. Naturforsch.*, **2a**, 432–5 (*Aug.*, 1947) *In German.*—Absorption and coincidence experiments are described which show that two processes occur: (*a*) A hard β-ray of 1·1 MeV, followed by a soft γ-ray of 0·23 MeV, ascribed to Ta^{182} formed by an (n,γ) process; (*b*) a soft β-ray of 0·28 MeV followed by a hard γ-ray of 1·4 MeV from Hf^{181} formed by an (n,p) reaction. A. P. F.

539.164 : 539.152.1 *see Abstr.* 694–5

539.164.08 : 535.376 = 3 729

On the excitation of phosphors by fast particles. I. A new method for detection and energy measurement of heavy charged particles. BROSER, I., AND KALLMANN, H. *Z. Naturforsch.*, **2a**, 439–40 (*Aug.*, 1947) *In German.*—A photomultiplier was used to detect single α-particle scintillations in ZnS, and the light pulses displayed on an oscillograph time base. The light quanta were mostly emitted within 10^{-5} sec, and scintillations thus easily distinguished from other disturbances of longer duration, such as cosmic ray ionization. S. T. H.

539.165 : 537.533.72 *see Abstr.* 660

539.165 : 537.533.74 730

Angular distribution of fast electrons scattered by aluminium nuclei. ARZIMOVICH, L., AND PERRYMOND, I. *C.R. Acad. Sci. URSS*, **52** (*No.* 4) 301–3 (1946).—Mott's formula for the scattering [Abstr. 3254 (1929)] is verified by experiments using electrons with energies 0·75, 1 and 1·5 MeV. Radon preparations up to 200–500 millicuries were used as electron sources, and a magnetic lens was used to sort out from the continuous β-spectrum a homogeneous electron beam. The beam was refocused on the scatterer by a second magnetic lens. The scatterers were from 11 μ to 38 μ in thickness. L. S. G.

539.165 : 537.533.75 = 3 731

A relation between energy and range for β-rays of small and medium energy. FLAMMERSFELD, A. *Z. Naturforsch.*, **2a**, 370–5 (*July*, 1947) *In German.*—A discussion of the experimental data which led up to a range-energy relation already published [Abstr. 2227 (1947)]. A. P. F.

539.165 : 539.163.2 *see Abstr.* 726

539.165.2 = 4 732

On β-disintegration. The phenomenon of *e*-creation. DAUDEL, R., JEAN, M., AND LECOIN, M. *C.R. Acad. Sci., Paris*, **225**, 290–2 (*Aug.* 4, 1947) *In French.*—See Abstr. 2970 (1947). Possible methods of detecting electron creation are suggested. The process should be much more probable than β-emission for a heavy nucleus if the available energy is not $> m_0c^2$. Removal of a *K*-electron may induce *e*-creation in a previously stable atom, by making available the binding energy in the *K*-shell. A. P. F.

539.166 : 535.34 733

The absorption of 17-Mev gamma-rays in lead and aluminium. MCDANIEL, B. D., VON DARDEL, G., AND WALKER, R. L. *Phys. Rev.*, **72**, 985–6 (*Nov.* 15, 1947).—γ-ray energy was measured by determining the sum of the energies of the positrons and electrons emitted at pair production. This was achieved by placing a sheet of Pb on the line joining two counters a fixed distance apart; the positrons and electrons of pairs produced by γ-rays falling on the Pb are deflected in opposite directions by a uniform magnetic field, and it is shown that the sum of the energies of pairs producing coincidence is practically constant no matter where they are produced in the Pb. By varying the magnetic field the energy sum of the detected particles can be varied. The curve of the number of coincidences against energy for γ-rays from $Li^7(p,\gamma)Be^8$ shows a peak at 17·5 MeV with a tail on the low energy side indicating the presence of some softer γ-radiation. Absorption in Pb and Al is measured by comparing peak height with and without the absorber. W. E. D.

539.166 : 539.163.2 *see Abstr.* 727

539.166.835 : 537.12 734

The production of a positron-electron pair in the electrostatic field of an electron. WATSON, K. M. *Phys. Rev.*, **72**, 1060–5 (*Dec.* 1, 1947).—In spite of the light mass the recoil electron and the exchange effect between t two electrons, the process is quite similar to ordina pair production. For the limiting case of high ener γ-rays, the ratio of triplet production to pair producti should ∝ 1/*Z*. For $h\nu/mc^2 < 30$, pair production w have a relatively greater cross-section for all values of (nuclear charge). It is found that in general (except ne the γ-ray energy threshold of $4mc^2$) the positron a one electron will have relatively high energy compared the second electron. [See Abstr. 666, 2230–1 (1947)]

539.167.3 7

Mass spectrographic assignment of activities to Re^{1} and Re^{188}. HESS, D. C., JR., HAYDEN, R. J., A INGHRAM, M. G. *Phys. Rev.*, **72**, 730 (*Oct.* 15, 1947). The 18-hr activity is assigned to mass 188 and the 90- to mass 186, the latter being produced by the 2·3 resonance absorption of neutrons. W. E.

539.167.3 : 537.591 : 550.423 : 539.155.2 7

Natural radiocarbon from cosmic radiation. ANDERSO E. C., LIBBY, W. F., WEINHOUSE, S., REID, A. I KIRSHENBAUM, A. D., AND GROSSE, A. V. *Phys. Re* **72**, 931–6 (*Nov.* 15, 1947).—A fuller report and discussi of the measurements reported in Abstr. 2642 (1947).

539.167.3 : 539.172 7

Radioactivity of Cu^{60}. LEITH, C. E., BRATENAHL, A AND MOYER, B. J. *Phys. Rev.*, **72**, 732–3 (*Oct.* 15, 1947). Cu^{60} has been produced by three processes: $Ni^{60}(p,$ $Ni^{60}(d,2n)$, and $Ni^{58}(\alpha,pn)$. It is shown that the ½-life Cu^{60} is 24·6 ± 0·3 min; that it emits two groups positrons with energies 1·8 ± 0·2 and 3·3 ± 0·2 Me and a γ-ray of energy 1·50 ± 0·05 MeV. The 81-s and 10-min activities, produced by $Ni^{58}(p, ?)$, are tent tively assigned to Cu^{59} and Cu^{58} respectively. W. E.

539.167.3 : 539.185.7 *see Abstr.* 761

539.169 73

Chemistry of energetic atoms produced by nucle reactions. LIBBY, W. F. *J. Amer. Chem. Soc.*, 6 2523–34 (*Oct.*, 1947).—The variety and nature of th recoil excitations suffered by atoms, the nuclei of whic participate in nuclear reactions, are reviewed. Th chemical kinetics of the recoiling atoms are considere under two headings, depending on whether or not change in atomic number is involved. When no chang is involved (e.g. reactions with organic halides) th mechanism is based essentially on classical collisio theory and the Franck–Rabinowitch "cage" and conform with the main experimental data. For reactions involvin a change in atomic number, few data are available, bu reactions involving ionic solids are considered. Th baking of fine irradiated crystals in order to concentrat the activity on the crystal surface is suggested. W. R.

539.172 : 537.133 73

Disintegration of the deuteron in flight. DANCOFF S. M. *Phys. Rev.*, **72**, 1017–22 (*Dec.* 1, 1947).— calculation is made of the cross-section for the dis integration of high velocity deuterons by nuclei in thei paths. In this paper attention is centred on thos processes in which there is no direct nuclear collisior and where the disintegration is due to electric force The cross-section for 200-MeV deuterons proves to b $\sim 2\times10^{-29}Z^2$ cm² (*Z* = atomic number of the bom barded element). Large yields may be expected in typica cases. The two ejected particles need not share th energy equally; neutrons of energy 75 MeV to 125 Me may be expected. They emerge in a fairly well collimate beam whose ½-width at ½-maximum ≃ 4°. Quantitativel this process proves usually to be less important than th

.egration involving a direct nuclear collision in
1 one of the two particles escapes. A.

72 : 539.167.3 *see Abstr.* 737

72.1 740

ergy levels of O^{17} obtained from $O^{16}(d,p)O^{17}$ and $(\alpha,p)O^{17}$. POLLARD, E., AND DAVISON, P. W. *Phys.* . **72**, 736–7 (*Oct.* 15, 1947).—Two proton groups are d in both these processes leading to a difference in gy release of 0·86 MeV and 0·81 MeV respectively, n agree within the limits of experimental error, and indicating an excited state of O^{17} about 0·85 MeV e the ground level. W. E. D.

72.1 741

citation curves for the reactions $C^{12}(d,dn)C^{11}$ and $(\alpha,\alpha n)C^{11}$ at high energies. THORNTON, R. L., AND MAN, R. W. *Phys. Rev.*, **72**, 872–3 (*Nov.* 1, 1947).—**tation curve for the reaction $C^{12}(p,pn)C^{11}$ up to Mev.** CHUPP, W. W., AND MCMILLAN, E. M. **72**, 873–4 (*Nov.* 1, 1947).—The activity in the three s rises fairly sharply at first with the energy of the lent particle, then more gradually to a const. value ·60 MeV for protons, ~ 150 MeV for deuterons and 50 MeV for α-particles. W. E. D.

172.1 : 539.185 : 537.133 742

ngular distribution of neutrons from targets bombarded 90 Mev deuterons. HELMHOLZ, A. C., MCMILLAN, ., AND SEWELL, D. C. *Phys. Rev.*, **72**, 1003–7 (*Dec.* 947).—It is found that 190 MeV deuterons striking in target produce a beam of neutrons concentrated t the forward direction of the deuterons. The ular distribution of intensity in this beam has been ied, using as target materials Be, Al, Cu, Mo, Sn, Pb, and U. The shape of the distributions is repre- ed approximately by the function $(1 + a\theta^2)^{-\frac{3}{2}}$, and measured widths in radians between points of tensity can be given approximately as $0{\cdot}155 + 0060Z$, where Z = atomic number of target material. pointed out that these data fit within a few per cent mple theory of neutron production [Abstr. 743 48)]. A.

172.2 : 539.185 : 537.133 743

he production of high energy neutrons by stripping. BER, R. *Phys. Rev.*, **72**, 1008–16 (*Dec.* 1, 1947).— en a target is bombarded with high energy deuterons, arrow beam of high energy neutrons is produced by rocess in which the proton in the deuteron strikes the e of the nucleus and is stripped off, while the neutron es and continues on its way. The cross-section for stripping process is $\sigma = \frac{1}{2}\pi RR_d$ (R = nuclear ius, R_d = deuteron radius), or $\sigma = 5A^{\frac{1}{3}} \times 10^{-26}$ cm². yield of neutrons from a ½-in Be target (in which the rgy loss for 190-MeV deuterons is 20 MeV) is ~ 2%. neutrons come out with an energy spread $\sim \frac{1}{2}E_d$ ing a ½-width $\Delta E_{\frac{1}{2}} = 1{\cdot}5(E_d\varepsilon_d)^{\frac{1}{2}}$. Here E_d is the etic energy of the deuteron, ε_d its binding energy. light nuclei the ½-width of the neutron angular ribution is $\Delta\theta_{\frac{1}{2}} = 1{\cdot}6(\varepsilon_d/E_d)^{\frac{1}{2}}$, and increases some- at with atomic number, primarily because of the iection of the deuteron by the Coulomb field as it proaches the nucleus, and, to a lesser extent, because multiple scattering in the target. The increase in idth from Be to U ≃ 25%. The calculated ½-widths f angular distributions agree well with measurements bstr. 742 (1948)]. An equal number of high energy tons are produced by stripping processes in which it he neutron that hits the nucleus. A.

172.3 : 539.185 *see Abstr.* 758

539.172.4 744

Energy distribution of the fragments resulting from the fission of U^{235} and Th^{232} by slow and by fast neutrons. FOWLER, J. L., AND ROSEN, L. *Phys. Rev.*, **72**, 926–30 (*Nov.* 15, 1947).—The distribution of energies of the fragments from U^{235} fission produced by slow and by fast neutrons were compared. The energy was determined by using a 10-channel amplitude discriminator to analyse pulses from a Frisch-grid ionization chamber. No difference was found outside the experimental error. The energy distribution of the fragments from Th fission was also determined. The high energy tails of the distributions were especially investigated for the purpose of detecting the occurrence of triple fission. This indicated a negative result. A possible correlation between the most probable mode of disintegration of the nucleus and its atomic number suggests itself. A.

539.172.4 = 3 745

Emanating uranium compounds. GÖTTE, H., AND RADOCK, G. *Z. Naturforsch*, **2a**, 427 (*July*, 1947) *In German.*—Ammonium uranate is a suitable substance for the separation of U-fission products by the Hahn and Strassmann method [Abstr. 1787 (1940)], but its emanating power depends on the method of preparation, and is very strongly influenced by atmospheric humidity. "*Iso*-butylamine-" and "tri-ethylamine-ammonium uranates" (actual composition doubtful) prepared by simple precipitation methods have higher emanating powers. C. B. A.

539.172.4 = 4 746

On the light particles emitted together with the fission fragments of thorium. TSIEN, S.-T., AND FARAGGI, H. *C.R. Acad. Sci., Paris*, **225**, 294–6 (*Aug.* 4, 1947) *In French.*—Observations were made on Th-loaded photographic plates exposed to a fast neutron flux. It is concluded that Th exhibits the same general behaviour as U and Pu. [See Abstr. 1628, 1629, 1632, 2241 (1947)]. A. P. F.

539.172.4 = 4 747

New modes of fission of uranium; ternary and quaternary fission. TSIEN, S.-T., HO, Z.-W., CHASTEL, R., AND VIGNERON, L. *J. Phys. Radium* (*Sér.* 8) **8**, 165–78 (*June*); 200–12 (*July*, 1947) *In French.*—A full review of the subject is given, collecting the results given in earlier papers [see Abstr. 746 (1948)], and adding a number of further details. The mass of the long-range light particle in ternary fission of U^{236} is given as 9 ± 2, the frequency of ternary fission as $0{\cdot}003 \pm 0{\cdot}001$ per binary fission. Fast neutron studies (fission of U^{239}) showed that in ~ 1·2% of all fissions a light particle of short range was emitted; in 10^4 fissions no long-range particles were found. Quaternary fission of U^{236} occurs $0{\cdot}0002 \pm 0{\cdot}00015$ per binary. The directionality of emission of the light particle in ternary fission is discussed. A. P. F.

539.172.4 : 539.152.1 748

Calculations in the liquid-drop model of fission. FRANKEL, S., AND METROPOLIS, N. *Phys. Rev.*, **72**, 914–25 (*Nov.* 15, 1947).—The model has been studied with the use of the Eniac electronic calculator. Classical deformation energies have been calculated for many shapes not all near-spherical. The shapes considered were axially and primarily, but not exclusively, bilaterally symmetric, and single-valued in polar representation. Previous calculations are confirmed and extended. Agreement with observed fission thresholds and spontaneous fission rates is obtained. No explanation of asymmetric fission is found. A.

539.172.4 : 539.163.2 = 3 *see Abstr.* 728

539.18 : 537.56 : 537.533.9 : 537.591.8 *see Abstr.* 676

539.18 : 537.591.1 *see Abstr.* 668

539.18 : 537.591.5 *see Abstr.* 672

539.18 : 537.591.8 *see Abstr.* 677

539.181 : 539.152.1 *see Abstr.* 696

539.181 : 539.153 *see Abstr.* 702

539.185 749

Resonance scattering of neutrons by cobalt. HARRIS, S. P., LANGSDORF, A. S., JR., AND SEIDL, F. G. P. *Phys. Rev.*, **72**, 866–7 (*Nov.* 1, 1947).—The Co^{59} resonance at 115 eV is shown to be mainly due to scattering, and the total peak scattering cross-section, σ_0, is found to be between 8 000 and 9 000 barn (10^{-24} cm²). Assuming the efficiency of the counter used for detecting the neutrons remains constant with varying neutron energy, E, a value of $\sigma_0\Gamma \sim 20\,000$ barn-eV is obtained where Γ is the total width of the resonance level. Assuming the counter efficiency varies as $1/\sqrt{E}$ the corresponding value of $\sigma_0\Gamma$ is 58 000 barn-eV. W. E. D.

539.185 750

Measurement of transport and inelastic scattering cross sections for fast neutrons. I. Method. BARSCHALL, H. H., MANLEY, J. H., AND WEISSKOPF, V. F. *Phys. Rev.*, **72**, 875–80 (*Nov.* 15, 1947).—Two experimental methods are described, using poor geometry, and back-scattering respectively. As detector, an ionization chamber with light gas and proportional amplifier was used, in which the sensitivity to neutrons above an adjustable "bias" energy rises rapidly from zero at that energy to a nearly constant value. A method of evaluation of the data is discussed. A.

539.185 751

Measurement of transport and inelastic scattering cross sections for fast neutrons. II. Experimental results. BARSCHALL, H. H., BATTAT, M. E., BRIGHT, W. C., GRAVES, E. R., JORGENSEN, T., AND MANLEY, J. H. *Phys. Rev.*, **72**, 881–8 (*Nov.* 15, 1947).—Values obtained with 0·2, 0·6, 1·5 and 3 MeV neutrons on C, Be, B^{10}, B^{11}, BeO, Al, Fe, Cu, CO, Ni, Ta, W, Au and Pb are given. A.

539.185 752

Scattering of neutrons in polycrystals. FINKELSTEIN, R. J. *Phys. Rev.*, **72**, 907–13 (*Nov.* 15, 1947).—Although elastic and first-order inelastic cross-sections for a neutron against a Debye crystal have already been determined, expressions for higher order inelastic collisions have not been calculated, and would be very complex for the Debye model. The calculation of the total inelastic cross-section involving the emission of an arbitrarily large number of phonons is here presented for a neutron against an Einstein polycrystal. The result, as one would expect, is essentially the same as that given by Fermi for amorphous scatterers, except at high neutron energies where the cross-section for the ejection of the struck nucleus from its lattice has been calculated. The coherent elastic cross-section is also determined; it is important for energies as high as 1 V, and does not differ appreciably from that previously calculated for a Debye crystal. The total cross-section, the sum of the coherent and incoherent parts, is compared with the experimental data on Be. A.

539.185 753

The neutron-scattering cross section at the cadmium resonance. BEEMAN, W. W. *Phys. Rev.*, **72**, 986–7 (*Nov.* 15, 1947).

539.185 = 3 754

The importance of heavy atoms in the slowing down of neutrons. KREBS, K. *Z. Naturforsch.*, **2a**, 435–8 (*Aug.*, 1947) *In German.*—Measurements of slow (In resonanc neutron densities were made at the position of t source for a Rn–Be source embedded in media containi varying amounts of H and other atoms (chiefly C a O). A considerable enhancement of slow neutr density due to the presence of heavy atoms was foun reduction of outward diffusion of the primary fa neutrons was suggested as the cause. A. P.

539.185 = 4 75

Space distribution of slow neutrons produced in wat by a Ra–α–Be source of fast neutrons. BERTHELOT, A BALLINI, R., AND VERMAESEN, L. *C.R. Acad. Sci., Pari* **225**, 292–4 (*Aug.* 4, 1947) *In French.*—The density di tribution was measured using Mn detectors. Goo agreement with similar experiments using BF_3 chambe was obtained. A. P.

539.185 : 530.162 75

Fluctuations of the number of neutrons in a pil COURANT, E. D., AND WALLACE, P. R. *Phys. Rev.*, 7 1038–48 (*Dec.* 1, 1947).—Statistical fluctuations in th number of neutrons in a pile which is just under critic and contains distributed neutron sources such as spo taneous fissions, $\alpha - n$ reactions, etc., are considere for the following two cases: (*a*) The delayed neutrons a taken into account, but the pile is assumed to be operatin at a steady power; (*b*) the power at which the pile operat is assumed to change periodically, but the delaye neutrons are neglected. For both cases the expressio for the standard deviation of the number of neutrons derived, and in case (*a*) the expression for the coefficie of correlation between the number of neutrons and th number of excited nuclei of each particular type, whic lead to the formation of the delayed neutrons, is als given. The method used throughout the calculations that of the probability generating function. For th case of a steadily operating pile, the effect of a finit resolving time of the recording instrument upon th observed value of the standard deviation of the numbe of neutrons is also determined through a study of th spectrum of the fluctuations.

539.185 : 537.133 : 539.172.1 *see Abstr.* 742

539.185 : 537.133 : 539.172.2 *see Abstr.* 743

539.185 : 539.163.1/.2 = 4 75

The validity of the $1/v$ law for vanadium and other therm neutron detectors: some properties of radioactive V^{5} MARTELLY, J. *Ann. Phys., Paris* (*Sér.* 12) **2**, 555–647 (*Nov. Dec.*, 1947) *In French.*—The decay of V^{52} was followe with an ionization chamber filled with A at 3 atmos. Aft correction of currents for non-saturation the perio (both β and γ) was found to be $3{\cdot}74 \pm 0{\cdot}01$ min. Th γ-ray energy was found from absorption measurement in Pb, Cu and Fe to be $1{\cdot}46 \pm 0{\cdot}05$ MeV. Using absorbers, a comparison of Ag and V detector activitie produced by a Ra–Be source in paraffin was made. Th activations of Ag, Dy and V by neutrons from paraffi at various temperatures were also compared. Approxi mate constancy of σv over the region of thermal energie for V and Dy was inferred. To study higher energies Cd-difference measurements were made with a BF chamber and V and Dy detectors on neutrons emergin from a paraffin block containing a Ra–Be source σv for V appeared somewhat higher than at therm energies; σv for Dy was much less ($\sim 0{\cdot}35$ of thermal) A. P. I.

539.185 : 539.172.3 75

Cloud-chamber energy measurement of photo-neutro sources. HUGHES, D. J., AND EGGLER, C. *Phys. Rev* **72**, 902–7 (*Nov.* 15, 1947).—The energy distributions o

neutrons from several photo-neutron sources have measured by means of the range distribution of il protons produced in a H-filled cloud chamber. shown that slowing-down in the source itself produces oad spread in energy instead of the almost mono-getic spectrum to be expected from a single γ-energy. values of the mean and the maximum neutron gy for the following sources are given: Na–Be; D_2O; Mn–Be; In–Be; Sb–Be. They are compared he γ-energies as reported by different observers for source. A.

185.4 = 3 759

owing down and absorption of neutrons in concrete. EN, P., AND RITTER, O. *Z. Naturforsch.*, **2a**, 376–84 *v*, 1947) *In German.*—Measurements were made of space distribution of neutrons of various energies in ge mass of concrete, and of transmission of neutrons ugh walls of various thicknesses. The results are of ication to neutron shielding problems. A. P. F.

185.7 760

he absorption cross section of gold for neutrons of gies from 0·01 to 0·3 eV. MCDANIEL, B. D., TON, R. B., LAVATELLI, L. S., AND ANDERSON, E. E. *s. Rev.*, **72**, 729 (*Oct.* 15, 1947).

185.7 : 539.167.3 761

hermal neutron activation cross sections. SEREN, L., EDLANDER, H. N., AND TURKEL, S. H. *Phys. Rev.*, **72**, -901 (*Nov.* 15, 1947).—The activation method of suring slow neutron cross-sections is discussed. A e is given listing 131 activation cross-sections of 65 nents and properties of the radio-isotopes produced. A.

STRUCTURE OF SOLIDS 539.2

.211 : 535.417 *see Abstr.* 595

.215.2 : 535.42 : 537.531 *see Abstr.* 656

539.215.4 : 548.734.3 : 539.26 = 3 *see Abstr.* 762

539.23 : 539.26 = 4 *see Abstr.* 763

539.26 : 539.215.4 : 548.734.3 = 3 762

On the relation between the X-ray and the arithmetic mean value of particle size. MÜLLER, H. *Z. Naturforsch.*, **2a**, 473–4 (*Aug.*, 1947) *In German.*—The particle size obtained from line-breadth measurements on a specimen containing crystals of the same shape but different sizes is the mean value of $(\text{size})^4$ divided by the mean value of $(\text{size})^3$, which is proved to be $>$ the arithmetic mean. A. J. C. W.

539.26 : 539.23 = 4 763

Study of surface layers by means of X-rays. LEGRAND, C. *C.R. Acad. Sci., Paris*, **225**, 731–3 (*Oct.* 27, 1947) *In French.*—By the use of X-rays either incident or emergent at a small angle with the surface, the thickness of the effective portion of the specimen can be reduced to $\sim 1\ \mu$. The gap between the thickness effective in ordinary X-ray studies and in electron diffraction is thus closed. A. J. C. W.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.32 : 669.14 : 534.15 764

Measurement of Young's modulus at high temperatures. ROBERTS, M. H., AND NORTCLIFFE, J. *J. Iron Steel Inst.*, **57**, 345–8 (*Nov.*, 1947).—The modulus was calculated from measurements of the frequency of the fundamental transverse vibrations of a cylindrical rod, maintained by a loud-speaker movement, and detected by a piezo-electric gramophone pickup. Various steels were measured up to 1 000°C; the results show a decrease at high temps., the value at 600°C being $\frac{3}{4}$ that at room temp. A.

539.501 : 532.5 *see Abstr.* 541

PHYSICAL CHEMISTRY 541

THERMO-CHEMISTRY 541.11

.11 : 535.342 = 3 *see Abstr.* 572–3

PHASE EQUILIBRIUM 541.121/.123

1.123 : 532.782 : 539.11 *see Abstr.* 686

REACTION KINETICS 541.124/.128

1.126 765

Velocity of detonation of a tubular charge of explosive. OODHEAD, D. W. *Nature, Lond.*, **160**, 644 (*Nov.* 8, 47).—The velocity in the wall of the tube was found to higher than in a solid charge, or a tubular charge ed with inert solid. A luminous effect within the ity was observed, propagated with a very much ger velocity still (12 500 m/sec) and may be at least rtly responsible for the phenomenon.

1.126 : 534.222.2 *see Abstr.* 557

1.126 : 536.462 766

The influence of water vapour on flame temperatures in rbon-monoxide explosions. LEAH, A. S. *Phil. Mag.*, , 657–72 (*Sept.*, 1947).—The explosion vessel used in evious experiments [Abstr. 393 (1944)] was replaced a new vessel with which most of the flame travel uld be studied. Previous results are confirmed. mperature variations are due to changes in the water-vapour content of the mixture, and with the driest mixtures extremely low temperatures are obtained. The possible causes of these are discussed. L. S. G.

ELECTROCHEMISTRY 541.13

541.133 : 538.569.3 *see Abstr.* 684

541.133.1 : 539.155.2 *see Abstr.* 706

COLLOIDS . DISPERSE SYSTEMS 541.18/.182

541.18.041.2 : 532.13 *see Abstr.* 539

ADSORPTION 541.183

541.183 767

On filtration through a sorbent layer. III. Sorption experiments with an ion exchanger. EKEDAHL, E., AND SILLÉN, L. G. *Ark. Kemi. Min. Geol.*, **25 A** (*Paper* 4) 26 *pp.* (1947).—See Abstr. 441–2 (1947). A solution of $AgNO_3$ (concentration a_0) was run through a column packed with a commercial sulphonic acid base cation exchanger, previously saturated with H. The concentration, a, of Ag leaking through was automatically measured by an Ag/AgI electrode as a function of time t; it obeyed the equation $a_0/a = 1 + 10^{k(t_0 - t)}$, ($k$ = constant $\times$ a_0 $\times$ (linear rate of flow)$^{\frac{1}{2}}$; t_0 is related to the sorption capacity of the layer). S. J. G.

541.183 : 531.19 768

Statistical mechanics of multimolecular adsorption. III. Introductory treatment of horizontal interactions. Capillary condensation and hysteresis. HILL, T. L. *J. Chem. Phys.*, **15**, 767–77 (*Nov.*, 1947).—See Abstr. 2391, 2970 (1946). The elementary treatment of interactions and first order phase changes in localized and mobile monolayers is reviewed. Calculations on multimolecular adsorption and capillary condensation, which take into account horizontal interactions in an approximate manner, are presented. Several other topics are discussed briefly, including the quasi-chemical method and reversible hysteresis. It is suggested, on the basis of the capillary condensation calculations, that reversible hysteresis involves the use of metastable portions of the adsorption isotherm. The theory predicts, in agreement with experiment, that the adsorption curve should be below the desorption curve. A.

541.183.1 769

Recent advances in surface chemistry. COCKBAIN, E. G. *Research, Lond.*, **1**, 115–22 (*Dec.*, 1947).—A review. Subjects dealt with are: monolayers at the air-water interface, their structure and phase transitions; phase changes in adsorbed films at the gas-solid interface; surface films of proteins and of synthetic polymers; monolayers at the liquid-liquid interface; kinetics of adsorption at the liquid-air interface; developments of biological interest including the mechanism of fat absorption. S. J. G.

541.183.1 = 4 770

Isotherm of activated adsorption on a heterogeneous surface. PRETTRE, M., AND GOEPFERT, O. *C.R. Acad. Sci., Paris*, **225**, 681–2 (*Oct.* 20, 1947) *In French.*—In many cases of activated adsorption on catalysts the isotherm can be represented as a sum of Langmuir isotherms: $v = \Sigma\{v_{mi}b_ip/(1 + b_ip)\}$ (v = total adsorption at pressure p; v_{mi} = limiting adsorption on the portion of surface having heat of adsorption Q_i; $b_i = k_x \exp\{Q_i/RT\}$). S. J. G.

541.183.1 = 4

Effect of temperature on adsorption on a heterogeneous surface. PRETTRE, M., AND GOEPFERT, O. *C.R. Acad. Sci., Paris*, **225**, 737–8 (*Oct.* 27, 1947) *In French.*—H_2 adsorbed on a Ni-kieselguhr catalyst at 438° and 456°K, the experimental isotherms can be accounted by assuming the surface to be divided into three nea equal portions, having Q-values of 72 000, 20 000, a 10 000 cal/mole respectively; and that each porti separately obeys the Langmuir equation. S. J.

541.183.56 : 537.226.1 *see Abstr.* 632

CHEMICAL STRUCTURE 541.4/.6

541.64 : 537.226.1 *see Abstr.* 633–4

541.651 : 535.66 7

Colour and constitution. The absorption of light chemical compounds. BOWEN, E. J. *J. Soc. Dy. Co Bradford*, **63**, 281–7 (*Sept.*, 1947).—The fourth Jo Mercer lecture of the Society prefaces the treatment present-day concepts based on wave-mechanics, by brief reference to the chemical theories of colour substances such as the Witt chromophores and aux chromes, the quinonoid theory of Armstrong, and t hypothesis of resonance between valency structur Following, comes a discussion of the energy levels hydrogen and a description of the absorption bands the hydrogen molecule, from which a picture is attempt of the characteristics of more complex molecules, e iodine, uranine, copper sulphate and methylene blu From the degree of conjugation it is shown that t longest wave absorption band steadily moves towar the red end of the spectrum from benzene to naphthalen and a similar effect is found in linear conjugated molecul such as ethylene and butadiene. The effect of solve on the light absorption of a substance is considered length. Finally, the directional character of lig absorption and of absorption due to an electron transition of one of the electrons in a double bond a considered. The paper is illustrated by 15 diagrams. H. H. H

CRYSTALLOGRAPHY 548

548.0 773

Physical properties and crystal structure of C_6F_{12}. CHRISTOFFERS, H. J., LINGAFELTER, E. C., AND CADY, G. H. *J. Amer. Chem. Soc.*, **69**, 2502–4 (*Oct.*, 1947).—Solid C_6F_{12} is soft and volatile, with a high coefficient of expansion; it has a transition at $\sim -105°$, probably owing to cessation of rotation of its molecules below this temp. The molecules are arranged in a cubic close-packed array as crystals with $a = 10{\cdot}00$ kx and an apparent molecular dia. of 7·07 kx. The crystals sublime at 51°, 760 mm and melt at $\sim 58{\cdot}2°$. The density at 23° is 1·93 g/ml. Mol wt is 302. W. R. A.

548.0 : 535.66 : 535.343.2 *see Abstr.* 574

548.0 : 539.16.08 : 537.529 *see Abstr.* 652

548.3 : 548.7 = 3 *see Abstr.* 777

548.5 : 537.228.1 = 4 774

The production of artificial crystals. I. The preparation of large-size single crystals. WYART, J., AND KURYLENKO, C. **II. Preparation of piezo-electric crystals.** BRUZAU, M. *Cah. de Phys.* (*No.* 27) 50–64 (*June*, 1945) *In French.*—I. A review of methods involving controlled cooling of molten material. There are 18 references. II. The theory of production of crystals from solution by evaporation or cooling is developed, and applied particularly to the production of large crystals. There a six photographs of fine specimens. A. J. C. W

548.528 : 536.422.15 : 536.7 = 3 7

On the range of validity of the Thomson–Gib equation. HONIGMANN, B., MOLIÈRE, K., AND STRANSK I. N. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 4–5) 181–9 (194 *In German.*—The vapour-pressure equation of a cube a crystal of the NaCl type as a function of the ed length is discussed in terms of the variation with cryst size of the energies required to create a corner, ur length of edge, and unit area of face. Numerical valu are obtained for crystals containing a few to a fe hundred atoms. A. J. C. W

548.7 : 535.37 *see Abstr.* 586

548.7 : 539.11 7

Intermolecular forces in soap crystals. VAND, V., AN DE BOER, J. H. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 991–1002 (1947).—The molecular cross-sections crystals of paraffins and fatty acid salts are calculate from X-ray diffraction data on the basis of certa assumptions. As the length of the C chain alters, change in cross-section is observed; in paraffins t cross-section becomes smaller as the chain gets longe but in fatty acid salts the reverse is the case. An attem is made to explain these results by a consideration of t

nge in van der Waals' forces and, in the case of the y acid salts, the balance between ionic and van der als' forces. J. I.

7 : 548.3 = 3 777

n vacant-site [Fehlordnung] phenomena in silver des with replacement. STASIW, O., AND TELTOW, J. *. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 4–5) 261–72 (1947) *In man.*—The theory of vacant lattice sites and inter- al ions in univalent ionic crystals is extended to cover te solutions of bivalent impurities. Solution of, e.g., S in AgBr implies that an interstitial Ag^+ tends to associated with each $S^=$ occupying a Br^- lattice , and solution of $PbBr_2$ implies a vacant Ag^+ site ociated with each Pb^{++} occupying an Ag^+ site. The ductivity as a function of the degree to which these ociations are dissociated is evaluated, and analysis of measurements of Koch and Wagner (*Z. Phys. Chem.* 38, 295 (1937)] shows that the dissociation increases decreasing temp., being ~ 50% at 350° and nearly plete at 200°C. A. J. C. W.

.73 778

Crystal structure of hydroxylammonium chloride and mide. JERSLEV, B. *Nature, Lond.*, **160**, 641 (*Nov.* 8, 7).—Unit cell dimensions and atomic arrangement given, with interatomic distances.

.73 779

Divergent beam X-ray photography of metallic single stals. GEISLER, A. H., HILL, J. K., AND NEWKIRK, B. *Phys. Rev.*, **72**, 983–4 (*Nov.* 15, 1947).—The tern of fine white absorption lines and black diffrac- n lines on a grey background produced by a widely ergent X-ray beam as observed by Lonsdale [Abstr. 93 (1947)] when incident on diamond and organic ostances has also been produced by a different hnique with some alloys. A collimated beam and the al transmission Laue camera were used, the divergent am apparently originating at the specimen. The perposition of Laue spots on the pattern is an added vantage. W. E. D.

3.73 = 4 780

Method for the precise determination of crystalline ttice] parameters. Application to a sample of mus-covite mica. BARRAUD, J. *C.R. Acad. Sci., Paris*, **225**, 310–12 (*Aug.* 4, 1947) *In French.*—The axial ratios and angles are obtained from the angles ψ made by suitable net planes with the normal to a reference face of the crystal. The reference face is set approximately normal to the incident beam and two Laue photographs are taken, the crystal being rotated by 180° about the beam between the two photographs. If ψ_1 and ψ_2 are the two measured values of ψ, the correct value is approximately given by $2 \tan 2\psi = \tan 2\psi_1 + \tan 2\psi_2$. A. J. C. W.

548.73 : 53.081.4 : 537.531 *see Abstr.* 653

548.731 = 4 781

Generalization of the Bragg-de Broglie principle of rotatory focusing for X-ray spectroscopy; application to two-crystal spectrographs; focusing and mosaic structure. PLASENCIA, H. T. *Cah. de Phys.* (*No.* 27) 18–32 (*June*, 1945) *In French.*—If the film-crystal distance is r and the slit-crystal distance is $R \neq r$, focusing in the Bragg and de Broglie sense is obtained when the angular velocities of the slit and film relative to the crystal are in the ratio of r to R. (This reduces to the Bragg and de Broglie condition for $r = R$.) With $r \neq R$, resolution is obtained in transmission also, the effective camera radius being $r - R$. Focusing is more exact if the centre of rotation of the film is the mirror image of the slit in the crystal; this involves translation as well as rotation of the film. The principle is extended to 2-crystal spectrographs, and the use of mosaic crystals in these instruments is discussed briefly. There are 7 figures and 32 references. A. J. C. W.

548.734.3 : 539.215.4 : 539.26 = 3 *see Abstr.* 762

548.74 = 3 782

Debye–Scherrer photographs from powder plates. MENZER, G. *Z. Naturforsch.*, **2a**, 335–43 (*June*, 1947) *In German.*—The absorption correction is worked out for powder photographs in which the specimen takes the form of a flat plate. Particular attention is paid to the correction for intensity and a comparison is given between the observed and calculated intensities in the case of MgO powder. J. T.

GEOPHYSICS 55

0.384.3(68) 783

The earth's magnetic field in Southern Africa at the och, 1 July, 1930. GRINDLEY, E. N. *Philos. Trans. A*, 0, 251–94 (*April* 29, 1947).—The field was determined that part of Africa south of the Zambesi and Kunene ers. Observations made at about 50 stations between 28 and 1930 have been used to determine the secular riation and thus the 1930–50 values of the magnetic ld at a large number of other stations. The magnetic clination changed linearly, the max. rate being in uth-West Africa. The horizontal intensity diminished a gradually increasing rate, the max. change being ar Cape Town. The declination varied at a high rate til 1928, but much more slowly since then. Maps ow the probable normal value of the declination, clination and horizontal intensity. L. S. G.

0.385 = 4 784

Magnetic storms. CHAPMAN, S. *Rev. Sci., Paris*, **85**, 7–400 (*April* 15, 1947) *In French.*—The author reviews) the statistical analysis of geomagnetic storms initiated Moos and applied by Chapman to obtain the average orm-time variation of 40 storms at 3 groups of bservatories in low, middle and relatively high latitudes, (*b*) the system of idealized current systems that could produce the observed magnetic variations for an average storm if these currents flowed in a conducting sheet concentric with the earth, and (*c*) points out that recent similar analysis carried out by Vestine for an individual storm is remarkable for the absence during the first phase of the intensification of the currents over the polar regions, which is so striking a feature of the current-system for an average storm. V. C. A. F.

550.423 : 539.155.2 : 537.591 : 539.167.3 *see Abstr.* 736

550.838 : 621.317.44 785

Air-borne magnetometers. FELCH, E. P., MEANS, W. J., SLONCZEWSKI, T., PARRATT, L. G., RUMBAUGH, L. H., AND TICKNER, A. J. *Elect. Engng, N.Y.*, **66**, 680–5 (*July*, 1947).—[Abstr. 579 B (1948)].

551.46 : 532.593 786

The generation and propagation of ocean waves and swell. I. Wave periods and velocities. BARBER, N. F., AND URSELL, F. *Philos. Trans. A* (*No.* 824) 528–60 (*Feb.* 24, 1948).—The problem studied is that of measuring the amplitude and period of the waves, together with the velocity of propagation over long distances. The

fluctuating pressure which the waves produce on an instrument laid on the sea bed in shallow water is measured. From the curves obtained a machine draws the frequency spectrum of the recorded waves. A study of these spectra together with information of wind strength supplied by meteorological charts allows a test to be made of the accuracy of the theoretical group velocity. The results agree to within about 5%. Examples studied in detail are: (1) a depression in the North Atlantic; (2) a tropical storm off the coast of Florida; (3) a swell originating in a storm off Cape Horn. The experiments were carried out in Cornwall, the swell, in these 3 cases, having travelled 1 200, 2 800 and 6 000 miles respectively. [See Abstr. 1063 (1947)]. L. S. G.

551.463 : 535.34 787

The penetration of radiation into natural waters. RICHARDSON, E. G. *Research, Lond.*, **1**, 106–10 (*Dec.*, 1947).—Describes work carried out, much of it during the war, on the penetration of light, including u.v. and infra-red, through sea water with varying amounts of suspended matter. Some applications are mentioned. J. W. T. W.

ATMOSPHERE . METEOROLOGY 551.5

551.508.4 : 533.43/.45 *see Abstr.* 549

551.510.535 788

F_2 ionization and geomagnetic latitudes. LIANG, P. H.; APPLETON, E. V. *Nature, Lond.*, **160**, 642–3 (*Nov.* 8, 1947).—Observations in agreement with earlier reports [Abstr. 1989 (1946), 482, 3387 (1947)] are given and briefly discussed.

551.510.535 : 551.515.4 7

Ionospheric measurements in connection with thund storm-research. STOFFREGEN, W. *Ark. Mat. Astr. Fy* **30 A** (*Paper* 19) 10 *pp.* (1944).—Equipment used at Upsa for the continuous measurement of the ionization of t *E*- and *F*-layers is described. The abnormal increase *E*-region ionization often observed during the summ is caused by thunderstorms. During strong activity the earth's magnetism, the effect of thunderstorms on t ionosphere is much lower. L. S.

551.515.4 : 551.510.535 *see Abstr.* 789

551.521.1(47) 7

Concerning maximum values of solar radiation intensit KALITIN, N. N. *C.R. Acad. Sci. URSS*, **52** (*No.* 305–7 (1946).—The maximum values are studied f 3 stations in Russia, situated at places having qui different climatic conditions. Graphs are given of t maximum values and of the coefficients of atmospher transparency, over the period 1915 to 1940. Graphs a also given of the humidity, temperature and pressure maximum radiation intensity. L. S.

551.521.3 : 535.343.4–15 *see Abstr.* 584

551.557 : 523.5 *see Abstr.* 499

551.594.5 : 535.338.3 = 4 . 7

The spectrum of helium in the aurora borealis. BE NARD, R. *C.R. Acad. Sci., Paris*, **225**, 352–4 (*Aug.* 1 1947) *In French.*—Spectra of the aurora show all t expected lines of He I which could reasonably be observe unblended, agreeing both in wavelength and relati intensities with lab. spectra of He I. D. L.

BIOLOGY 57/59

578 : 539.155.2.08 *see Abstr.* 708

578.088.74 : 621.396.615.17 792

A versatile electronic stimulator for nerve and muscle. NASTUK, W. L., AND BORISON, H. L. *Rev. Sci. Instrum.*, **18**, 669–72 (*Sept.*, 1947).—[Abstr. 745 B (1948)].

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

612.17 793

An instantaneous recording cardiotachometer. STURM, R. E., AND WOOD, E. H. *Rev. Sci. Instrum.*, **18**, 771–6 (*Oct.*, 1947).—The instrument includes an electronic circuit which deflects a galvanometer at a constant rate. The swing of the galvanometer is interrupted an returned to the zero position by the *r* wave of the electr cardiogram. Thus, each galvanometer deflection is the time interval between successive *r* waves and $\propto$ 1/(heart rate). The instrument can be adapted t record the pulse rate from opacity, volume or pressur pulse impulses.

612.84 : 628.9.04 = 5 79

Research on glare from automobile headlights. PERUCC E., AND FERRERO, M. *Elettrotecnica*, **28**, 570–9 (*Dec.* 1 1941) *In Italian.*—[Abstr. 431 B (1948)].

615.849 : 535.43 : 537.531 *see Abstr.* 657

GLASS . CERAMICS 666

666 795

Chemical aspects of some mechanical properties of glass. WEYL, W. A. *Research, Lond.*, **1**, 50–61 (*Nov.*, 1947).—A descriptive account of chemical aspects of many physical properties of glass, including diffusion of gases through glass, viscous flow, mechanical damping, elasti after-effect, mechanical strength and hardness. G. O.

METALLURGY 669

669.14 : 534.15 : 539.32 *see Abstr.* 764

669.35 : 536.413 *see Abstr.* 600

PHOTOGRAPHY 77

771.531.1–834 : 539.16.08 *see Abstr.* 396

771.534 : 778.33 : 537.531 796

The photographic action of X-rays of wavelengths 2·5–25 Å. ENGSTRÖM, A., AND LINDSTRÖM, B. *Experientia*, **3** (*No.* 10) 410–11 (1947).—The density/intensity curves were measured for various wavelengths in the range, using primary X-rays filtered through 0·009 mm Al; four of the curves are reproduced. All the curves are linear up to a density value of at least 0·15.

771.534.531.51 : 537.533.73 : 535.247.4 *see Abstr.* 283

778.3 : 539.16.08 = 5 *see Abstr.* 716

778.3 : 621.317.3.082.5 79

A sensitive photographic recorder. ELLIOTT, A., AN AMBROSE, E. J. *J. Sci. Instrum.*, **24**, 324–5 (*Dec.*, 1947).— [Abstr. 559 B (1948)].

778.33 : 537.531 : 771.534 *see Abstr.* 796

778.33 : 616–073.75 *see Abstr.* 486